Service Manual

for all versions of the

Cranex D

and

Cranex D Ceph

Dental X-ray Unit

8201086 rev. 2 (0905)

Eng

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for all versions of the

Cranex D

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Cranex D Ceph
Dental X-ray Units

CE
0537

Medical Device Directive
93/42/EEC

Code 8201086 rev.2 (0905)

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1. General Information

1.1 Introduction

This manual describes how to service all versions of the Cranex D and Cranex D Ceph.

1.2 Unit versions

The are two versions of the unit:

- versions 1 and 2 have the original "dark blue" control panel and GUI. Serial numbers **B81642 and earlier**.

- version 3 have the "light grey" control panel and GUI. Serial numbers **B91643 and later**.

1.3 Associated documentation

The Cranex D Pan/Ceph User's manual.
The Cranex D Pan/Ceph Installation manual.
The Cranex D Pan/Ceph Spare-parts manual.

1.4 Service warnings and precautions

Servicing precautions

Only Soredex trained and approved service personnel are allowed to service the Cranex D and Cranex D Ceph.

Before attempting to service the unit make sure that you know how to operate it. Read the Cranex D user's manual.

Only use original Soredex spare parts when repairing the unit or replacing parts.

The unit is factory set to operate using **either** a 230VAC power supply **or** a 115VAC power supply. Never try to operate the unit using a power supply different to the voltage marked on the unit.

Radiation Safety

Before servicing the unit familiarise yourself with local and national radiation safety standards and requirements relating to dental x-ray equipment.

If you need to take test exposures you MUST take adequate steps to protect yourself from radiation. Use a lead apron or stand behind a suitable radiation shield. In addition, when taking an exposure stand at least two metres (six feet) from the unit.

Mechanical safety

Switch the main power supply off before repairing or replacing mechanical parts.

Be careful when operating the unit not to get body parts or clothing trapped between moving parts.

The aperture plate in the collimator is made of lead (Pb) which is a toxic material. Do not touch it with your bare hands.

During operation some surfaces may become hot. When working on the unit take suitable precautions to avoid burning yourself.

DO NOT open the tube head.
There are no serviceable parts, mechanical or electrical, inside the tube head.

Electrical Safety

Switch the main power supply off before repairing or replacing parts. When leaving the service area during service, always disconnect the unit from mains to protect any extraneous persons from electric shock.

Live electrical terminals are deadly.
Be sure that power switch is OFF and that precautions have been taken before opening access doors, removing enclosures and panels, or attaching accessories.

This equipment should be used only in areas that are provided with a protective earth connection to ensure an equipotential ground connection.

Before cleaning or disinfecting the unit switch the main power supply off.

Electrostatic discharge

Electrostatic Discharge (ESD) can damage or destroy electronic components.

When servicing the unit take proper precautions to avoid electrostatic build up and discharge (ESD). Follow the recommendations for the prevention of ESD that are used in the country in which you are working. If no recommendations are available follow the guide lines below.

Before handling any electrical parts or components make sure that any static electricity charge that has built up in you body is discharged.

When handling electrical parts or components use an elasticated wrist wrap which is connected to a ground point through a 1 Mohm current limiting cable. For a ground point use water pipes, radiators or other objects that are known to be connected to the ground. Also use a cable to connect the unit to the same ground potential as the wrist wrap.

If an antistatic mat is used, connect the wrist wrap to the mat and the mat to the ground potential.

Wash the wrist wrap and check that it is in good condition frequently.

Explosion Hazard

Certain disinfectants and cleaning agents may vaporize to form an explosive vapour. If such chemicals are used the vapour should be allowed to disperse before switching the unit on.

1.5 Operating warnings and precautions

Also refer to the Warnings and precautions in the Cranex D /Cranex D Ceph User's manual.

The Soredex Cranex D x-ray unit must only be used to take dental, TMJ and cephalometric (optional) x-ray exposures. It must not be used for any other purpose.

The unit or its accessories must not be modified, altered or remanufactured in any way. Repairing shall be performed by Soredex authorized service only.

The x-ray unit may be dangerous to both patient and operator unless safe exposure values are used and correct operating procedures are observed.

When taking exposures operators must protect themselves from radiation by using a lead apron or by standing behind a suitable radiation shield.

When taking exposures operators must stand at least two metres (six feet) from the patient.

Operators must be able to see and hear the patient during an exposure.

Operators must be able to see the exposure warning lights and hear the exposure warning signal during exposures. If the X-ray unit is located in such a position that the operator cannot see the exposure warning lights, an external exposure warning light must be used.

As radiation safety and protection requirements vary from country to country and state to state it is the responsibility of the operator to ensure that all local and national radiation safety and protection requirements are met.

Avoid taking exposures of pregnant women.

The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system. Consideration relating to the choice shall include:

– use of the accessory in the PATIENT VICINITY

– evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 601-1 or IEC 950 and/or IEC 601-1-1 harmonized national standard.

– for units with serial number **B81642 and earlier** use the RS-232C serial interface cable, provided by the manufacturer shall be used.
  NOTE:
  units with serial number **B91643 and later** DO NOT require the RS-232C serial interface cable.

If this device will be used with 3rd party imaging application software not supplied by SOREDEX, the 3rd party imaging application software must comply with all local laws on patient information software. This includes, for example, the Medical Device Directive 93/42/EEC and/or FDA if applicable.

1.6 Unauthorized Modifications

Unauthorized changes or modifications to any part of the unit or its equipment can have hazardous consequences. Changes or modifications must not be made unless specifically authorized by Soredex.

When properly assembled with a compatible beam-limiting device, the diagnostic source assembly will fully meet the United States of America Federal Performance Standards for Diagnostic X-Ray Systems and Their Components (21 CFR 1020. 30-32) provided no components or parts are removed from the unit and no unauthorized adjustments are made to the beam-limiting device or tube housing assembly.
Never remove or remanufacture any part of the tube housing assembly or beam-limiting device.
Never adjust any part of the beam-limiting device unless under the direction of Soredex or their authorized distributor.

1.7 Disclaimer

Soredex shall have no liability for consequential damages, personal injury, loss, damage or expense directly or indirectly arising from the use of its products. No agent, distributor or other party is authorized to make any warranty or other liability on behalf of Soredex with respect to its products.

2. Unit description

2.1 The Cranex D and Cranex D Ceph

The Cranex D Pan and Cranex D Pan/Ceph are digital extraoral x-ray units designed to take exposures of the dento-maxillofacial region.
The units cannot be used to take x-ray exposures of any other part of the human anatomy.

The Cranex D Pan unit is used to take panoramic, sinus and TMJ images.

Cranex D Pan/Ceph unit is used to take panoramic, sinus, TMJ and cephalometric images.
The Cranex D Pan/Ceph unit can be supplied with the ceph arm mounted on either the left- or right-hand side of the column.

NOTE: The ceph arm is also available as a retrofit kit that can be installed to a pan unit that was not originally fitted with a ceph arm.

An optional adaptor allow carpel images to be taken (not available in the USA)

All units are factory set to operate using **either** a 230 VAC power supply **or** a 115 VAC power supply.
The voltage setting CANNOT be changed.

The Cranex D Pan and Cranex D Pan/Ceph are used with a PC in which Digora for Window or any other MDD approved dental imaging software is installed.

2.2 Unit versions

The unit version can be identified from the unit type label is located at the rear of the unit next to the main power cable.

PP 1 0 1 2 - 0 1 2

Product identification

Country or language code
- 00 General (English)
- 01 UK only
- 02 German
- 03 USA
- 05 France
- 06 Finland and Sweden
- 07 Russia
- 08 Italy
- 09 Spain
- 2X OEM version
- 3X OEM version

X-ray tube type
- 0 OPX/105
- 1 DE 100/15ö
- 2 D-051
- 4 KL5

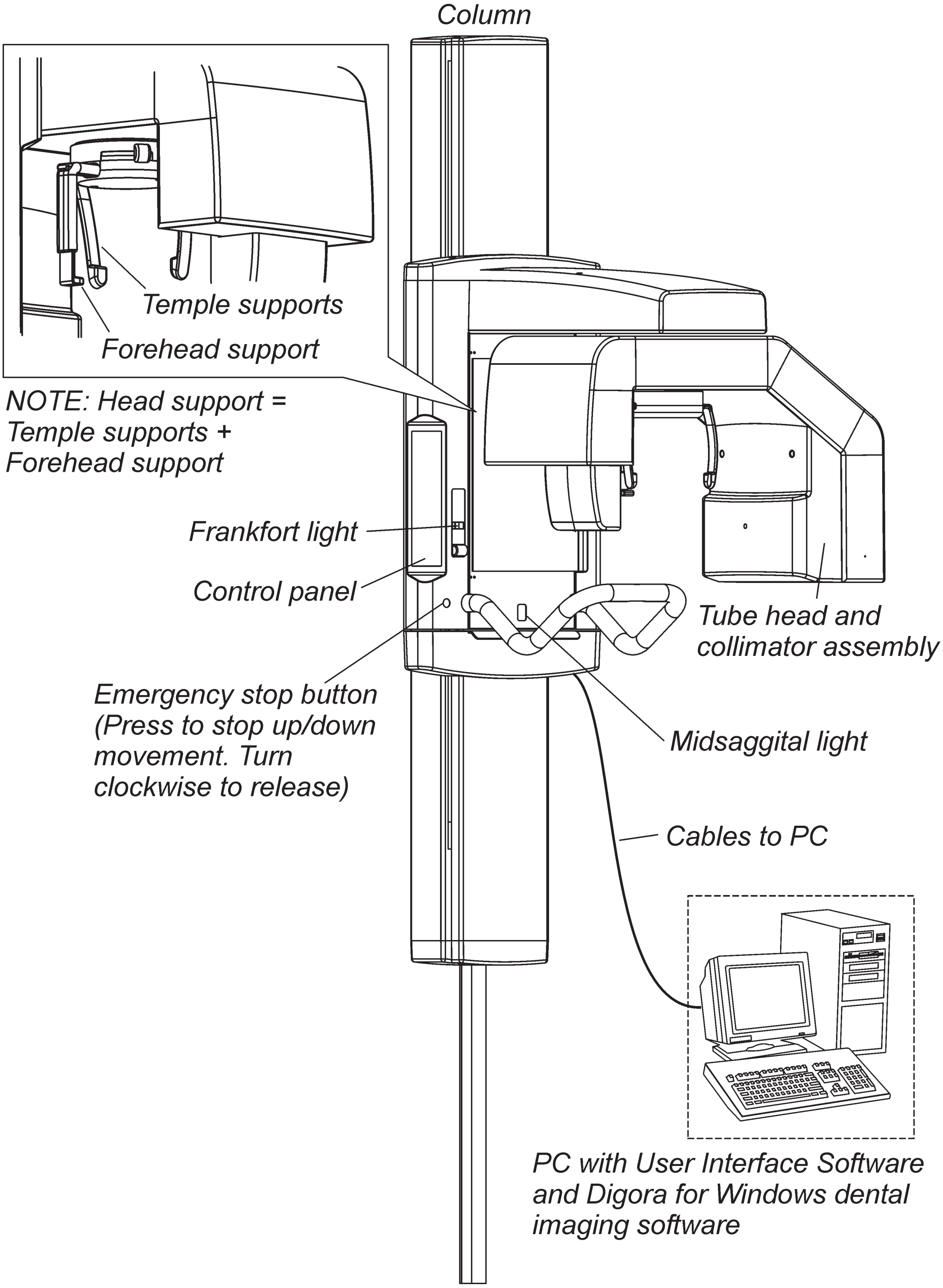
Type of unit
- 0 Pan unit only/ no ceph unit
- 7 Left-hand ceph - digital unit
- 8 Right-hand ceph - digital unit

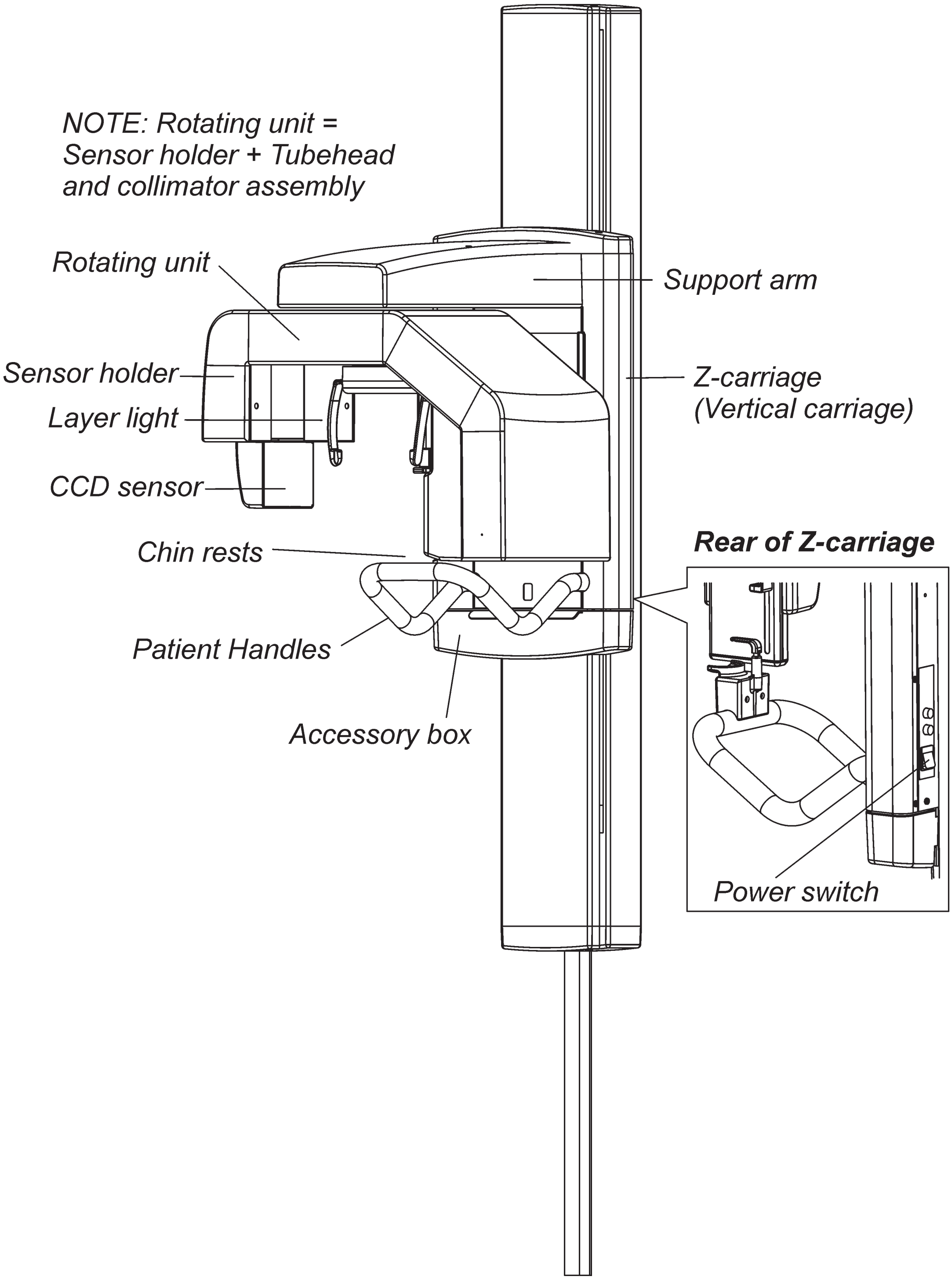
- 0 Cassette unit (not used)
- 1 Digital unit (removable sensors)

The production version
- 0 Pilot production version
- 1 1st production version
- 2 2nd production version, **s/n B81642 and earlier**
- 3 3rd production version (facelift) **s/n B91643 and later**

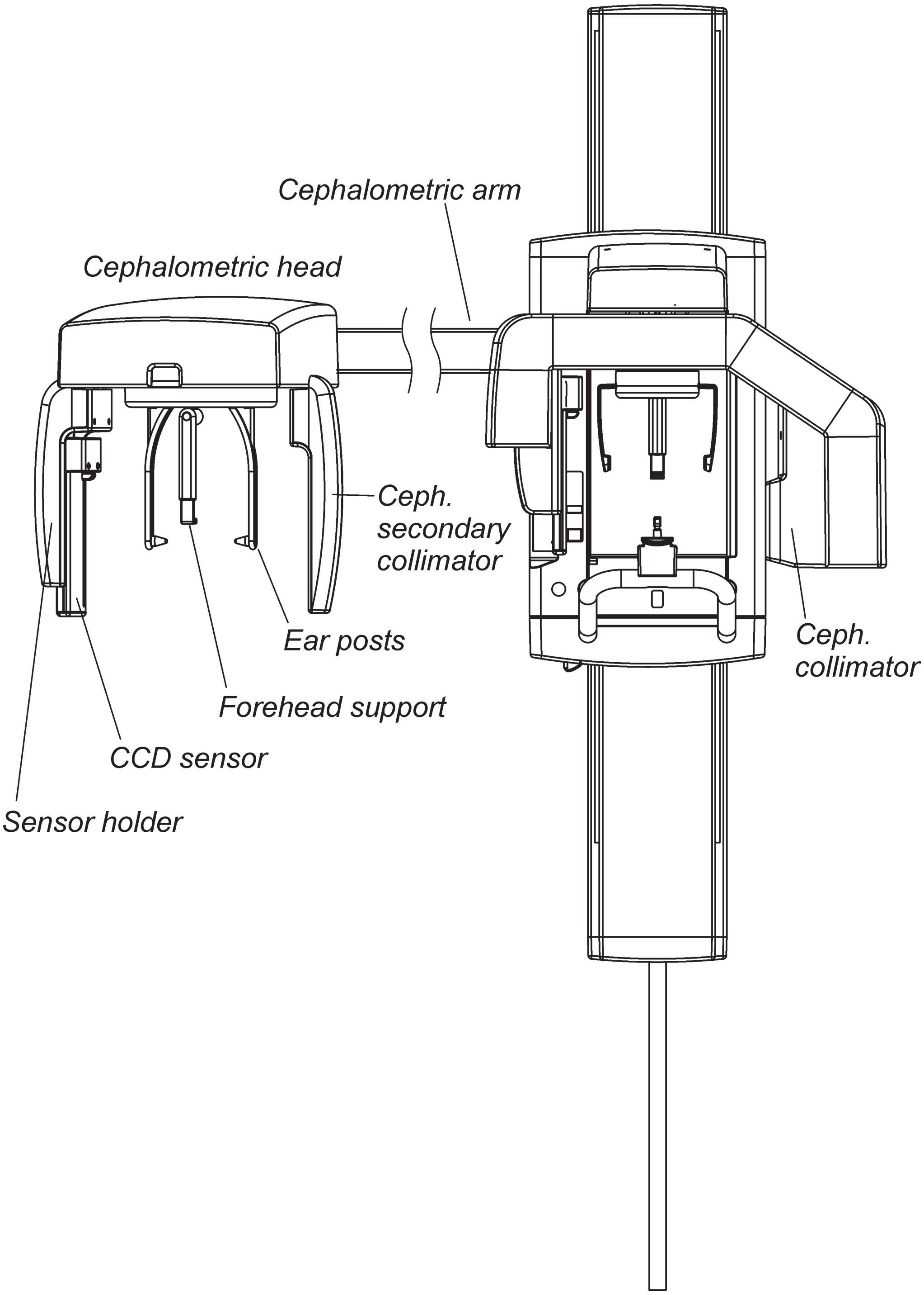
2.3 The main parts and assemblies

The Cranex D Pan



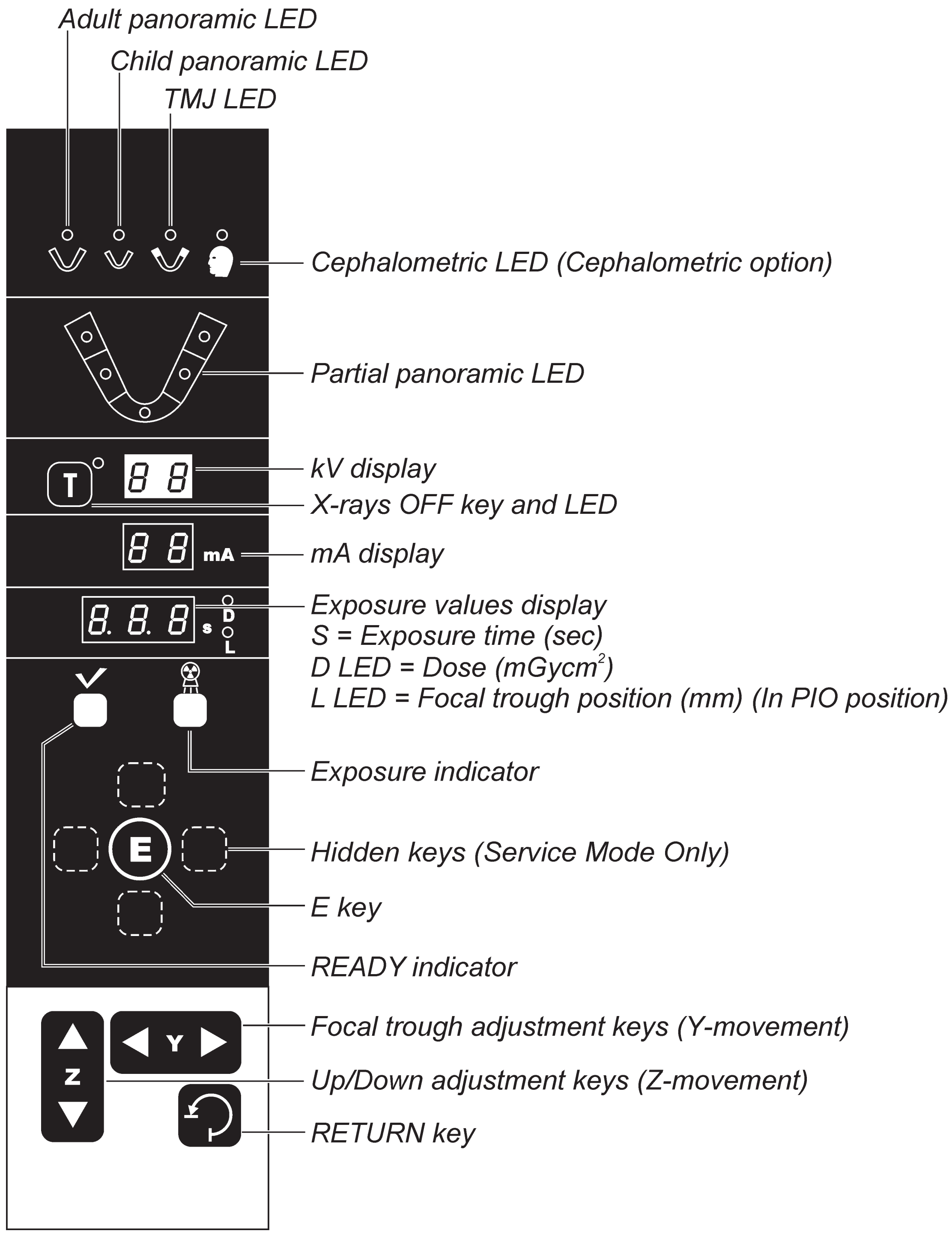

NOTE: Rotating unit =
Sensor holder + Tubehead
and collimator assembly
Rotating unit
Sensor holder
Layer light
CCD sensor
Chin rests
Patient Handles
Accessory box
Support arm
Z-carriage
(Vertical carriage)
Rear of Z-carriage
Power switch

The Cranex D Pan/ceph



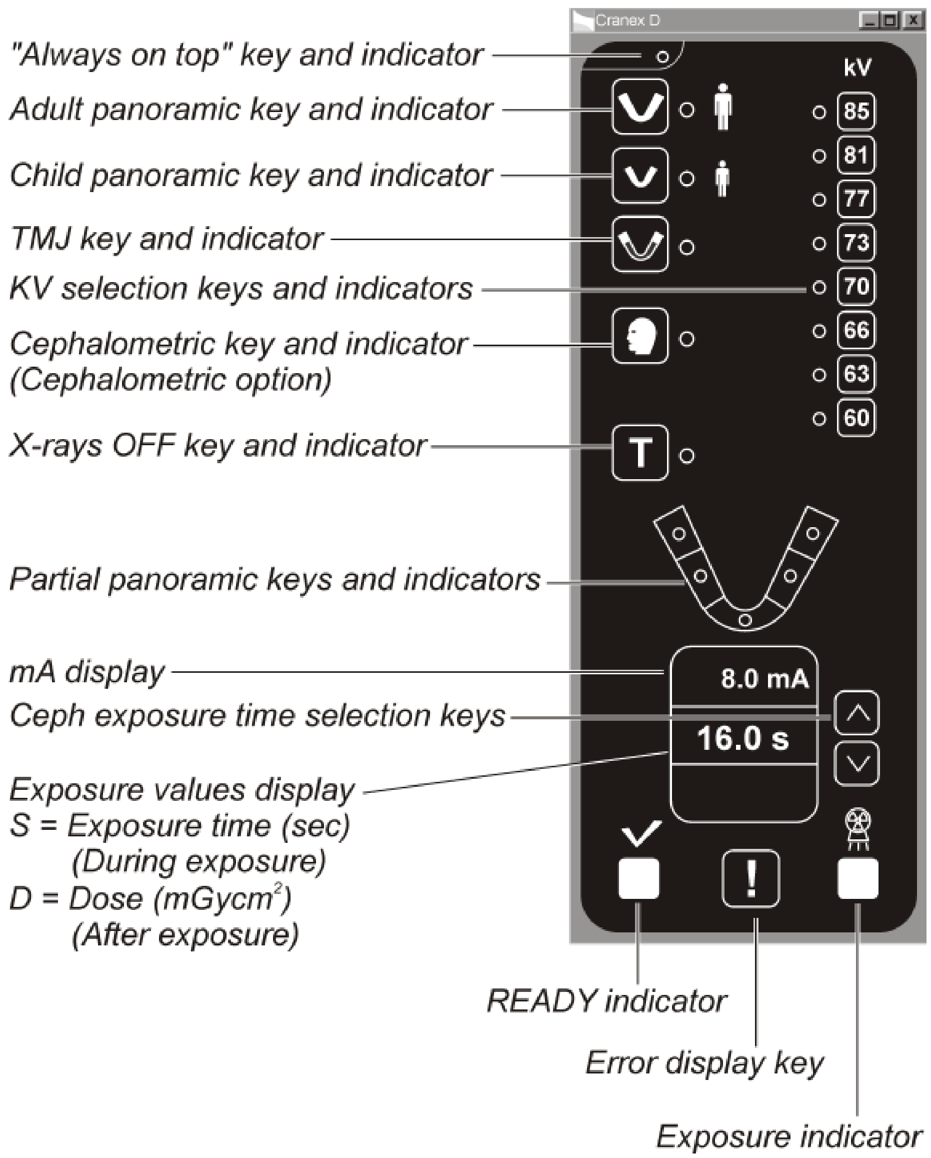
2.4 User interfaces

Control panel - s/n B81642 and earlier

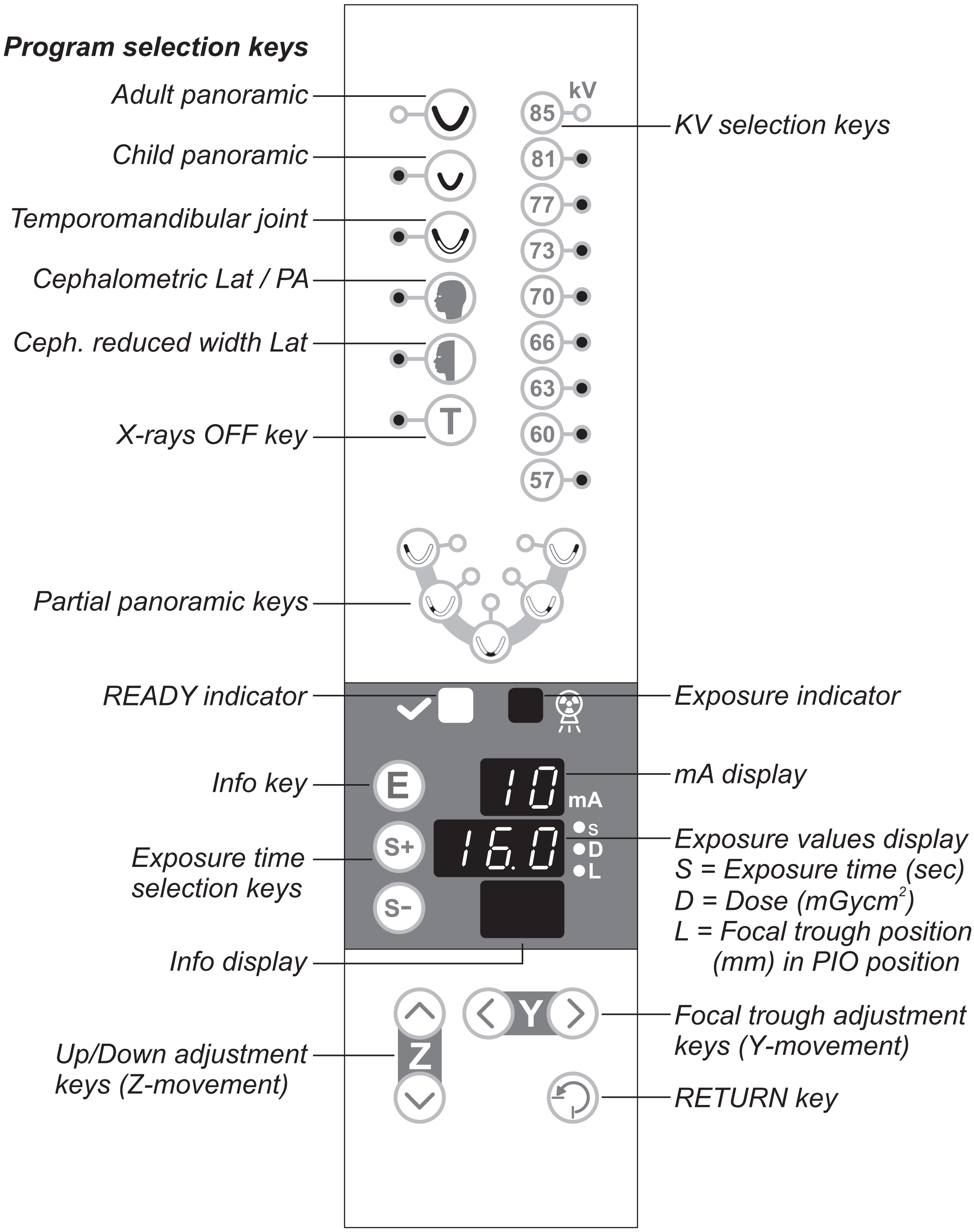


The Hidden keys are active only when Test Connector (SERVICESW 4801744) is connected to X90 on the Digital I/O board (N5200).
ALWAYS remove the test connector after use.

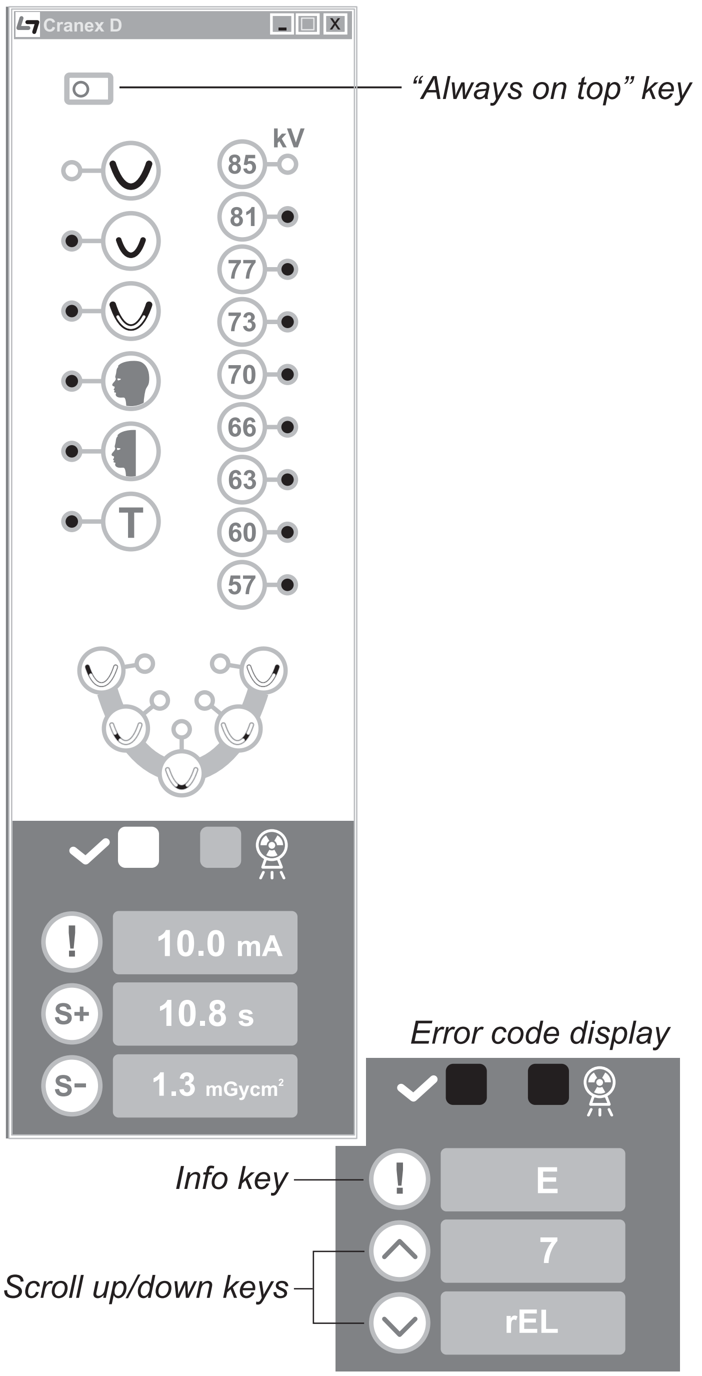
Graphical user interface - s/n B81642 and earlier



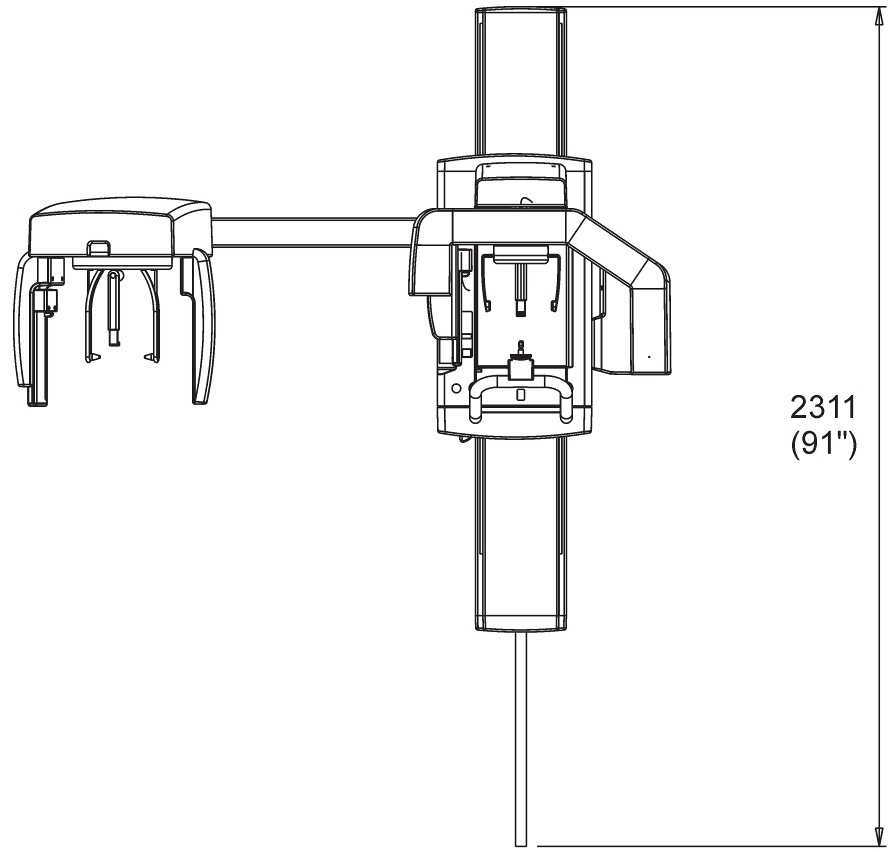
Control panel - s/n B91643 and later

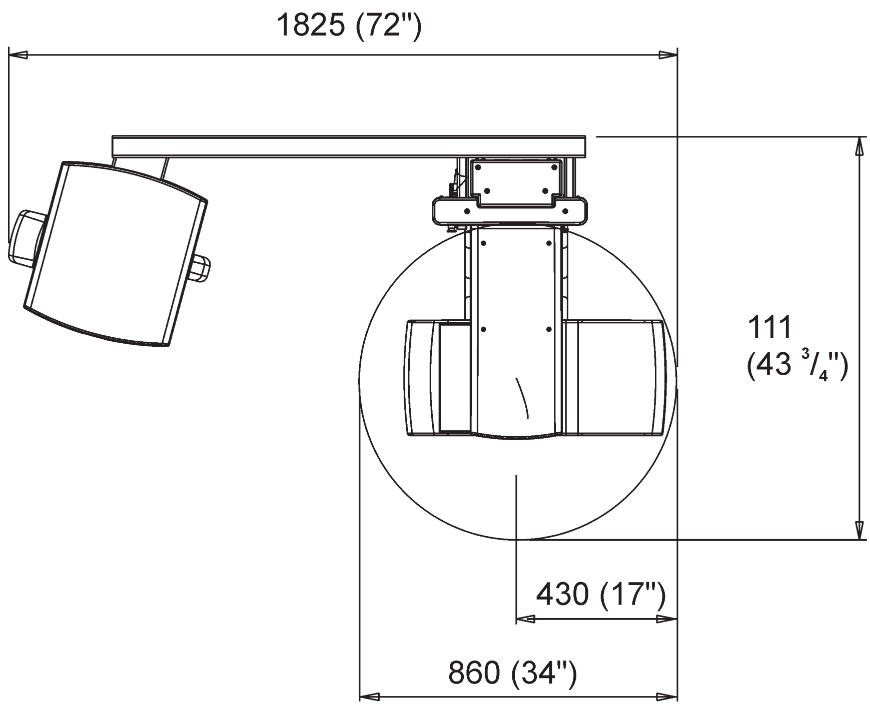


Graphical user interface - s/n B91643 and later



2.5 Unit dimensions





2.6 CCD Image Receptors (Sensors)

The Cranex D Pan and Cranex D Pan/Ceph use CCD sensors as the image receptor.

Two versions of the CCD sensor are available:
- CCD Image Receptor PP1-1 (sensor type 1)
- CCD Image Receptor PP1-2 (sensor type 2)

CCD Image Receptor PP1-1 (sensor type 1) can ONLY be used with the Cranex D Pan. This sensor can only be used to take panoramic images

CCD Image Receptor PP1-2 (sensor type 2) can be used with BOTH the Cranex D Pan and the Cranex D Pan/ Ceph. This sensor can be used to take panoramic and cephalometric images.

2.7 The link to the PC

Unit versions with s/n B81642 and earlier

A RS232 serial interface cable (part number 4801742) is used to link the unit to the PC.
The serial interface protocol is: 8 databits, 1 stop bit, no parity, 4800 Bd.

Fibre optic cable (4801743).

Unit version with s/n B91643 and later

Fibre optic cable (4801743) ONLY.

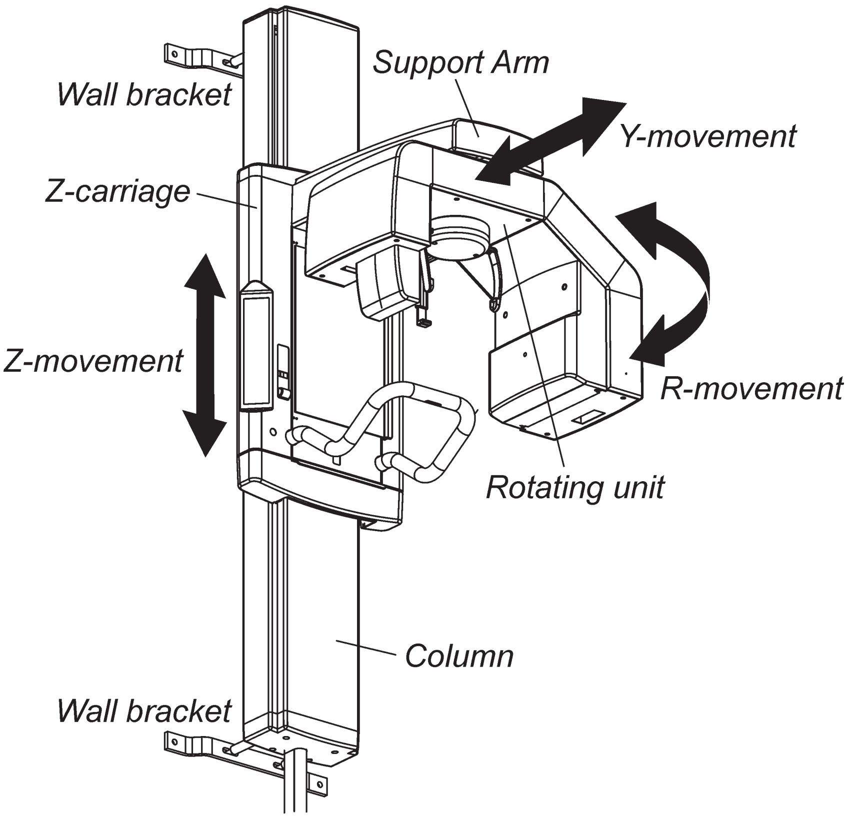
2.8 Mechanical description

The Cranex comprises a column, a Z-carriage (Vertical-carriage), a support arm, a rotating unit and a patient support assembly.

The column rests on the floor and is fixed to the wall using two wall brackets.
If the unit needs to be free standing it can be attached to a stand (part no. 9802666)

The Z-carriage (vertical carriage) is attached to the column and can slide up and down the column (Z-movement, for unit height adjustment). The Support Arm is attached to the top of the vertical carriage.

The rotating unit, which comprises the tubehead and collimator assembly and the sensor holder, is attached to the underside of the support arm. The rotating unit is able to slide backwards and forwards along the support arm (Y-movement, for patient positioning and panoramic/ceph exposures), and is also able to rotate (R-movement - for panoramic/ceph exposures) .



Inside the tube head there is the x-ray tube. It is a fixed tungsten anode type with a focal spot of 0.5. The maximum anode voltage is 85kV and maximum current is 10mA. X-ray beam filtration is 2.5 mm Al minimum.

The patient support assembly is attached to the bottom of the vertical carriage. It comprises handles for the patient to hold and a lower jaw support device

The patient is held in position with a four-point support system. The head support holds the patient's temples and the forehead, and the patient support assembly supports the patients lower jaw, either using a chin or lip support.

There are three patient positioning lights, midsagittal plane, horizontal plane and focal trough.

The optional cephalostat can be mounted either on the left or right-hand side of the column depending upon what was specified when the unit was ordered.

2.9 Electrical description

Circuit board names and locations

NOTE: A complete description of all the circuit boards, including circuit diagrams and component layouts can be found in Section 6. Circuit Board Description.

PCI

- N3000

Upper shelf

- N4700 Power Supply Board

- N5300 Top Rack Connector Board

- N4600 Y-layer Sensor

Z-carriage (Vertical carriage)

- N3500 Motor Controller

- N3600 Control Panel (< s/n **B81642**)
- N3601 Control Panel (> s/n **B91643**)
  IMPORTANT NOTE:
  N3600 and N3601 are **NOT** interchangeable.

- N3700 Display Board (< s/n **B81642**)
- N3701 Display Board (> s/n **B91643**)
  IMPORTANT NOTE:
  N3700 and N3701 are **NOT** interchangeable.

- N4100 Frankfurt Light

- N5000 Insulation Board (Optocoupler)

- N5100 C167 Core Module (CPU) (< s/n **B81642**)
- N5101 C167 Core Module (CPU) (> s/n **B91643**)
  IMPORTANT NOTE:
  N5100 and N5101 are **NOT** interchangeable.

- N5200 Digital I/O board

Rotating unit (image receptor side)

- N3100 Rotation Connector Board

- N3800 Rotation Position Sensor

- N4100 Y-Layer Light (focal trough light)

- N5700 DIB Sensor Connector Board (Pan sensor)

- N5800 Data Interface Board

- N5900 Pan Terminal Board (< s/n **B81642**)
- N5901 Pan Terminal Board (> s/n **B91643**)
  IMPORTANT NOTE:
  N5900 and N5901 are **NOT** interchangeable.

Rotating unit (tubehead side)

- N3200 Filament Control Board

- N3300 Inverter Board (tubehead s/n **90-----**)
- N3301 Inverter Board (tubehead s/n **91-----**)
  IMPORTANT NOTE:
  N3300 and N3301 are **NOT** interchangeable.

- N5400 Tubehead Board (Inside tubehead)

- N5500 Slit board (Collimator position)

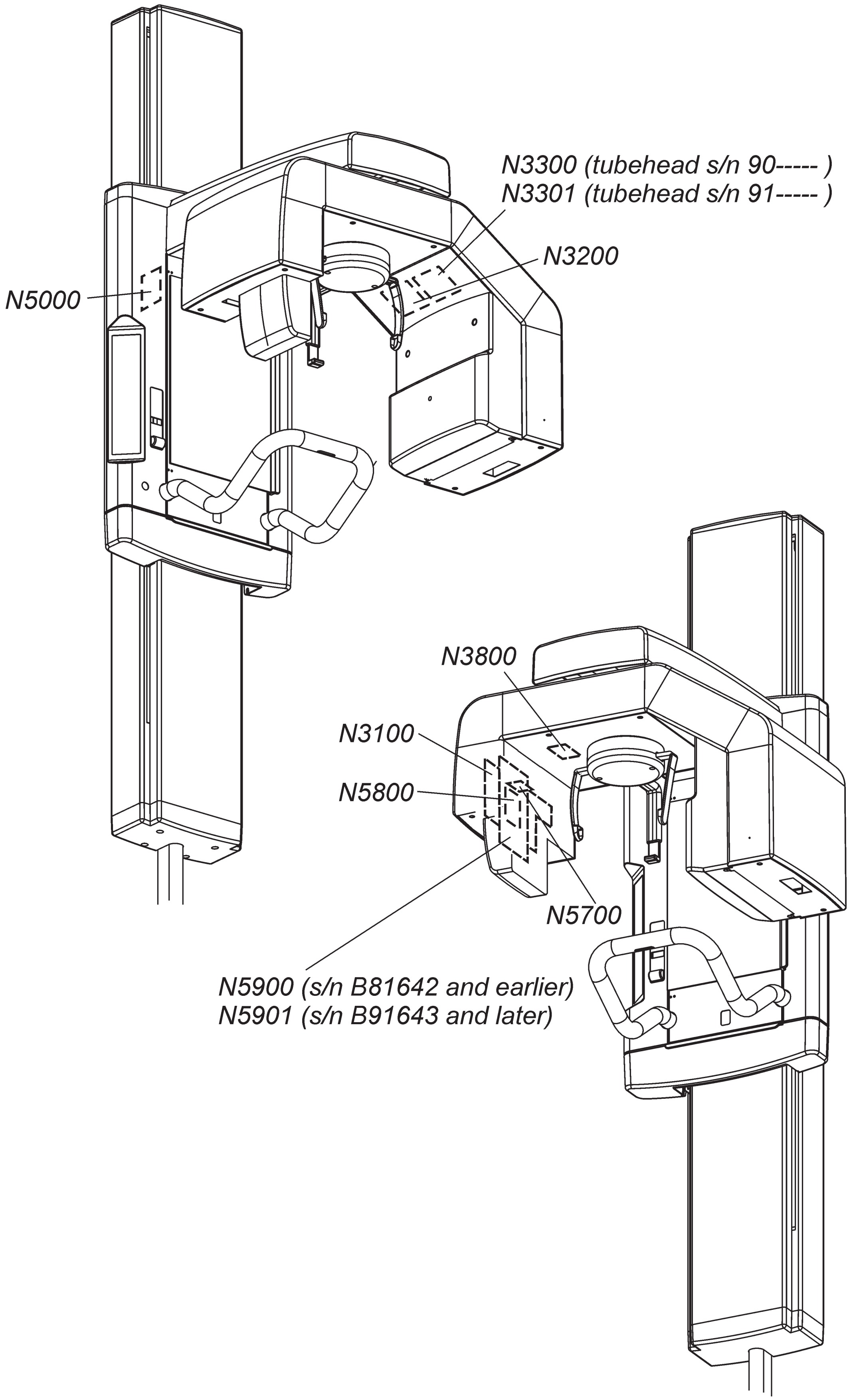
CCD Sensor

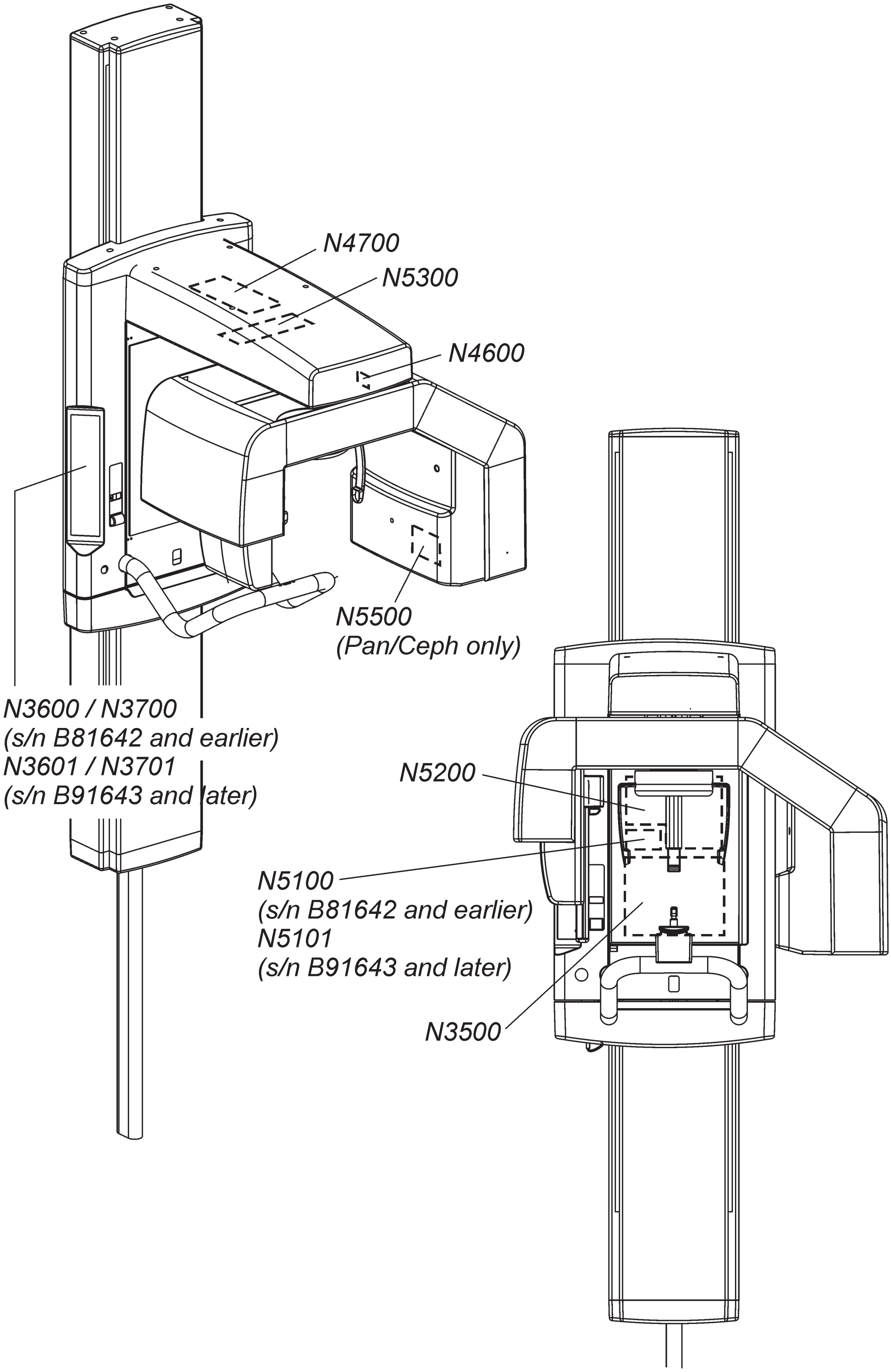
- N5600 CAM (CCD sensor) Connector Board

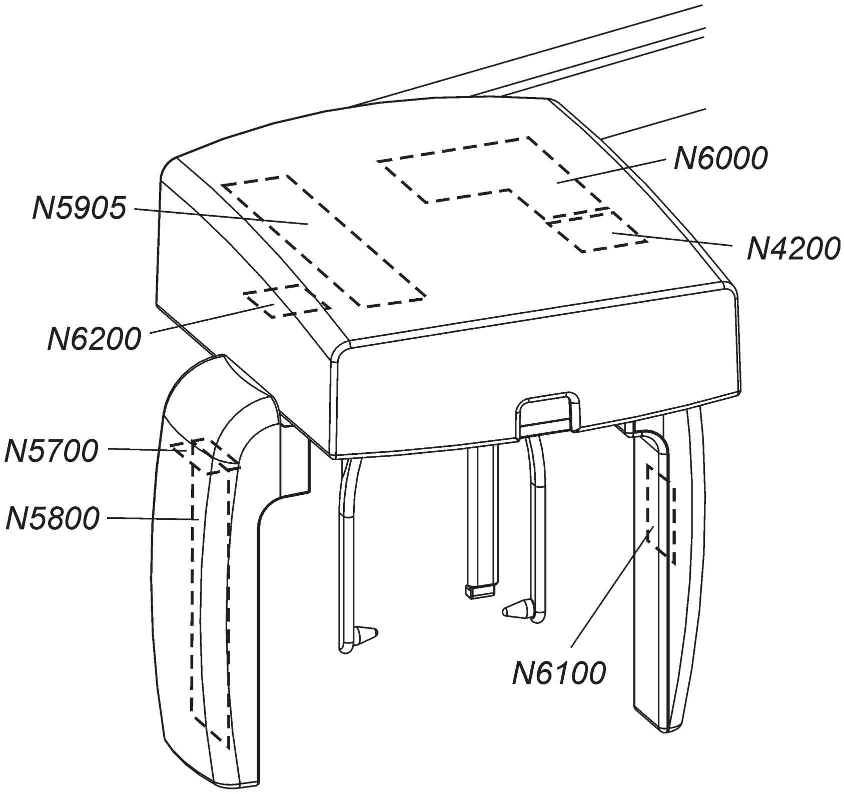
- None Pan/Ceph Camera (CCD Sensor board)
  (No information provided)

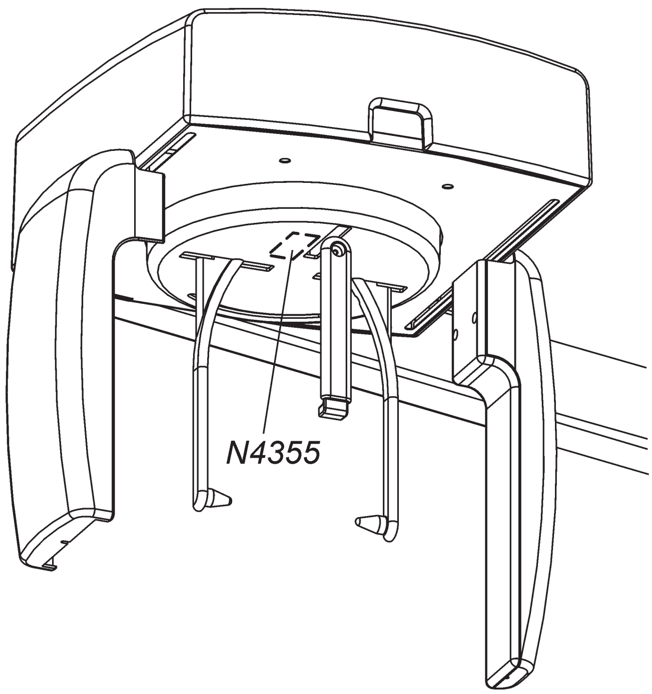
Ceph head

- N4200 Ceph Connector Board
- N4355 Ceph Filter Position
- N5905 Ceph terminal Board
- N6000 Ceph Head Board
- N6100 Beam Alignment Board
- N6200 Movement detector board


N3300 (tubehead s/n 90-----)
N3301 (tubehead s/n 91-----)
N3200
N5000
N3800
N3100
N5800
N5700
N5900 (s/n B81642 and earlier)
N5901 (s/n B91643 and later)


N4700
N5300
N4600
N5500
(Pan/Ceph only)
N3600 / N3700
(s/n B81642 and earlier)
N3601 / N3701
(s/n B91643 and later)
N5200
N5100
(s/n B81642 and earlier)
N5101
(s/n B91643 and later)
N3500


N6000
N5905
N4200
N6200
N5700
N5800
N6100


N4355

Power supply

Mains voltage (230VAC or 115VAC) is supplied to the unit through the **N3500** board (Motor Controller). From the **N3500** board power is routed to the **N4700** board (Power Supply) which is a linear mode power supply. The **N470**0 board generates the low-voltage power supplies (±25V and +34V) for all the boards in the unit. The low-voltage power supplies are distributed to the other boards via the **N5300** board (Top Rack Connector Board).
The **N4700** board also supplies mains voltage, (230VAC or 115VAC), directly to the tube head. The x-ray generator comprises the **N3300** board (Inverter Board) and the **N5400** board (Tubehead Board). The **N5400** board is located inside the tubehead and cannot be accessed.

Unit control

The unit is controlled by a microprocessor on the **N5100 / N5101** board (Core Module) that continually monitors and controls the operation of the unit. A serial peripheral interface communication protocol (SPI - RS485) and direct digital I/O are used to monitor most of the unit functions.
The microprocessor:
- monitors the optosensors and microswitches
- monitors control panel keys
- controls unit movements during exposures
- starts, controls and stops x-ray generation
- monitors the safety interlocks
- controls the digital imaging chain

The necessary unit settings and parameters for all the imaging programs are stored in the memory circuit which is also located on the **N5100 / N5101** board.

Motors and motor control

There are three stepper motors and one AC-motor in the Cranex D Pan. One stepper motor moves the rotating unit towards and away from the column, the Y-movement. Another stepper motor rotates the rotating unit, the R movement. During exposures these motors are controlled by the **N3500** board (Motor Controller).
Note that if the rotating unit is moved during exposure setup it will automatically return to the PIO position.

The third stepper motor selects the primary collimator and is controlled by the **N3500** board.

The AC-motor is used to adjust the height of the unit, the Z movement, and this motor is activated directly by the N3500 board and controlled by the unit software through the **N5100 / 5101** and **N5200** board. To activate the Z-motor it must receive a control signal from the **N5100 / 5101** board and a separate control (enable) signal from the Z-movement (up/down) keys. The unit is also provided with an emergency switch on the front of unit which will disable the z-movement when activated (pressed).

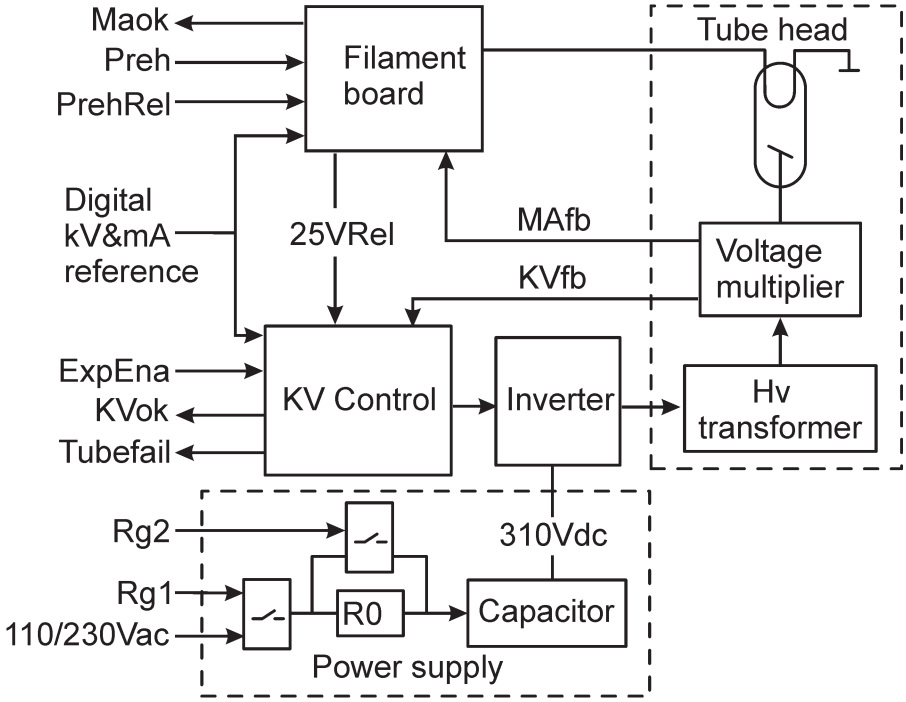
The Cranex D Pan/Ceph has an additional stepper motor in the ceph head that drives the collimator and the primary slit.

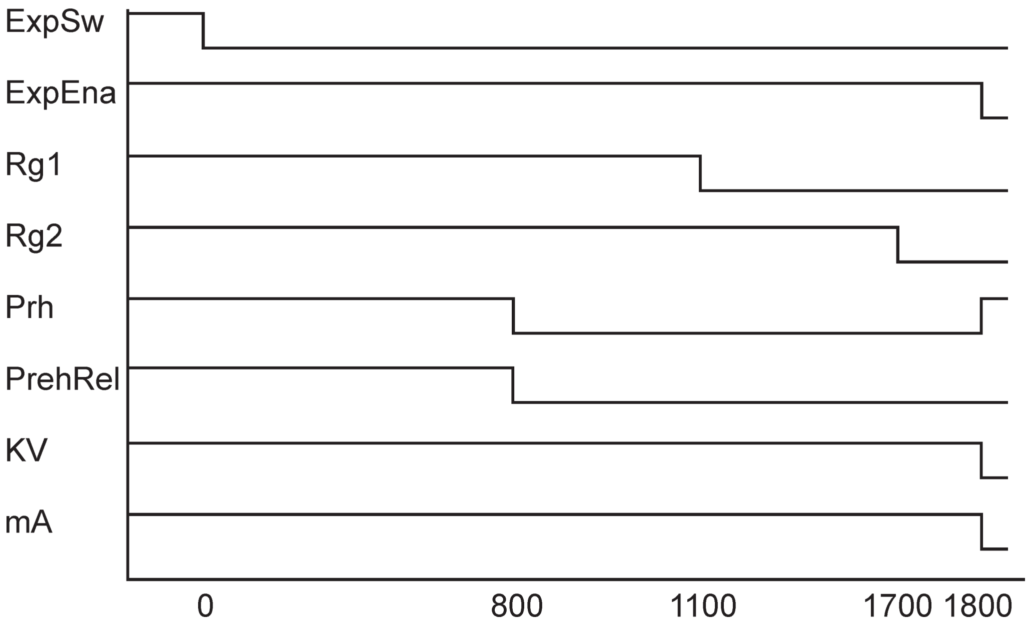
Exposure logic

A exposure can only be taken when the unit is in the ready state and the exposure button is pressed.

The Filament and Inverter boards receive the correct kV and mA references from the CPU. When the exposure button is pressed it takes 800ms to start preheat and preheat release. After 1100ms Rg1 starts to charge the large rectifier capacitors through a charging resistor. After 1700ms the rectifier capacitors are charged and Rg2 will bypass the charging resistor. 1800ms after pressing the exposure button ExpEna will come on and preheat will be stopped.

The tubehead will receive power and the filament and inverter boards will start to regulate the mA and kV according to the mA- and kV- feedbacks.


Maok
Preh
PrehRel
Filament board
Tube head
Digital kV&mA reference
25VRel
MAfb
KVfb
Voltage multiplier
ExpEna
KVok
Tubefail
KV Control
Inverter
Hv transformer
Rg2
310Vdc
Rg1
110/230Vac
R0
Capacitor
Power supply


ExpSw
ExpEna
Rg1
Rg2
Prh
PrehRel
KV
mA
0
800
1100
1700
1800

Position control

The positions of the mechanical assemblies are monitored by optosensors and microswitches.
The optosensors only respond to start or stop positions and do not control unit movements. The optosensors ensure that the mechanical assemblies are in the correct PIO (Patient in/out) or start position for the required exposure.
The statuses of the optosensors are monitored continually by the unit software.

The position of the primary aperture (the selected slot) is monitored, by sensors mounted on the **N5500** board (Slit brd).
NOTE:
The **N5500** board is only in Pan/Ceph units.

The C-arm rotation position is monitored by optosensors on the **N3800** board (Rotation sensors) .

The position of the CCD sensor holder is monitored by optosensors on **N6200** board (Movement Detection Board).

The positions of the mirror, the vertical carriage (upper and lower limits) and the ceph PA/LAT positions are all monitored by microswitches.

A overview of the Imaging Chain

This description assumes that the unit is ready to take an exposure.

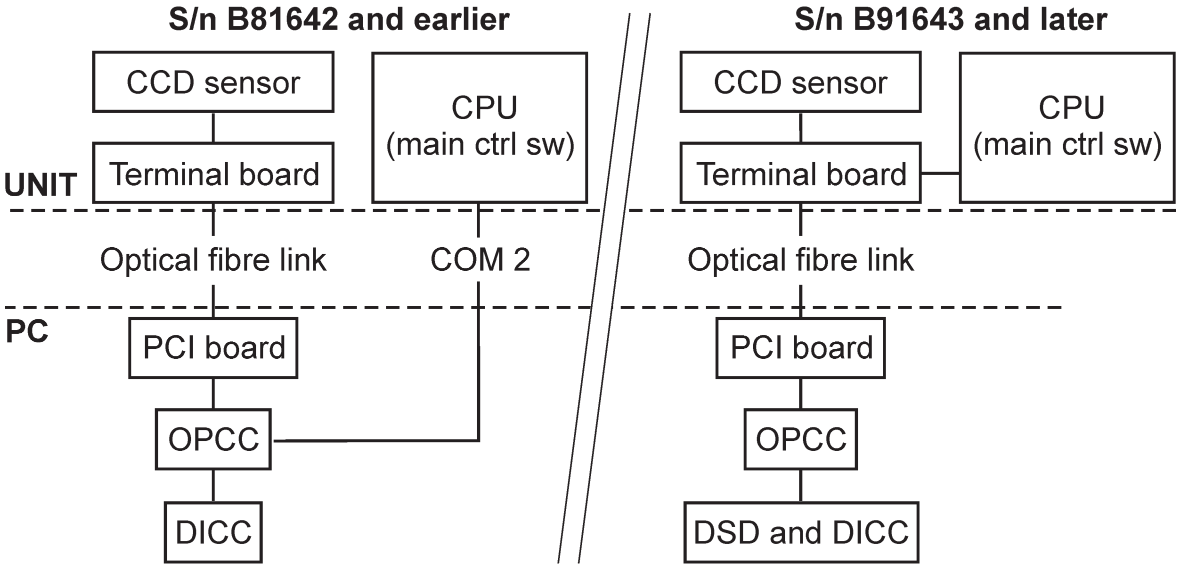


Image acquisition is controlled by a software component(s) installed in the PC.
For unit versions with s/n **B81642 and earlier** it is the DICC (**d**igital **i**maging **c**apture **c**omponent)
For unit versions with s/n **B91643 and later** they are the DICC **(d**igital **i**maging **c**apture **c**omponent) and **the DSD (D**igora **S**canora **D**river). The DICC sends a message to the Cranex D that tells it what type of CCD sensor(s) are attached to the unit, type 1 and/or type 2.

The embedded software on the unit CPU (main control software) continuously sends “OK” messages to the DICC driver (PC). After pressing the exposure button the CPU sends a so-called label which contains imaging parameters (—kV/—mA/ —s) and an imaging program identifier.

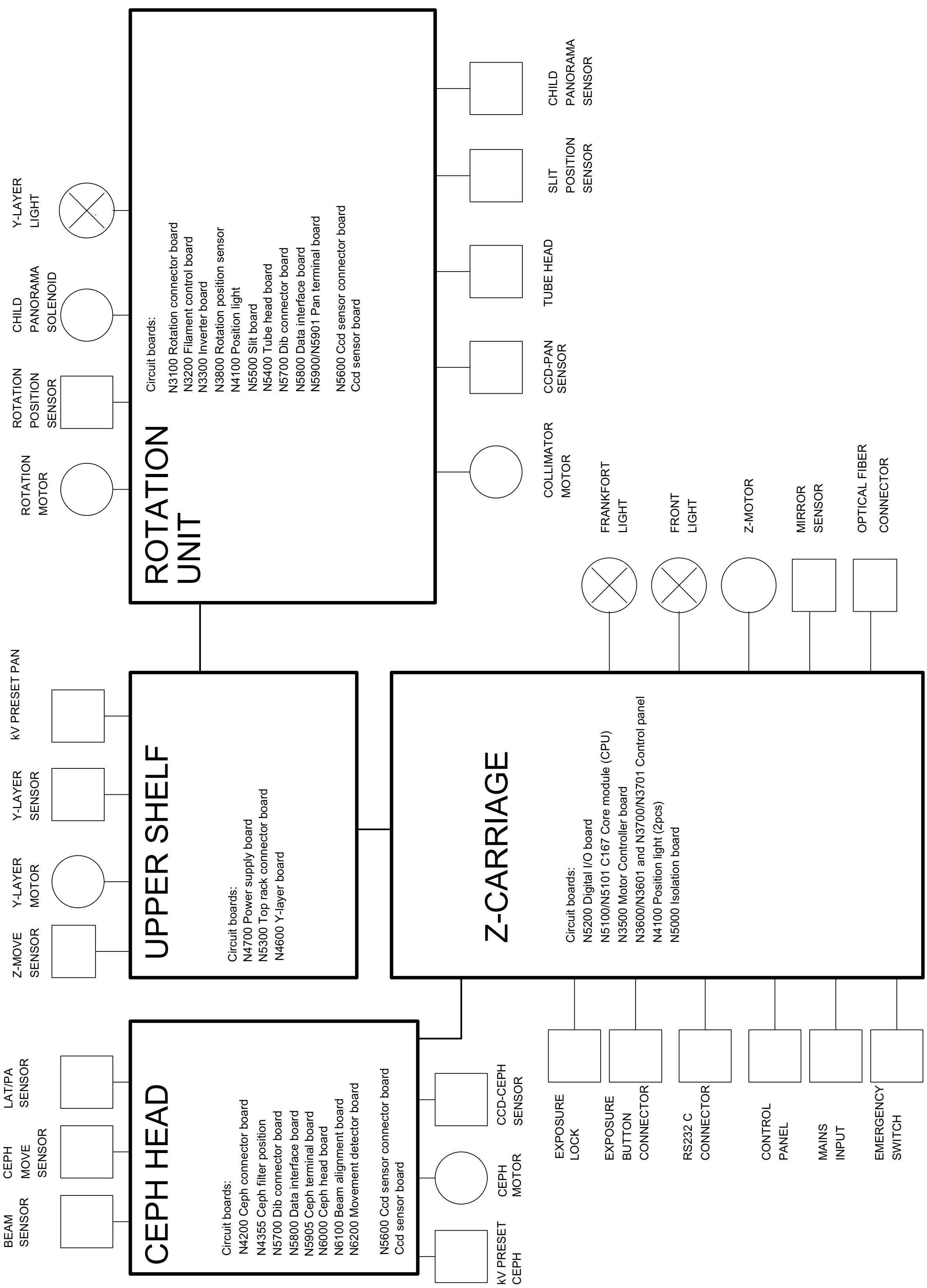
The CPU then sends a PPOWER (pan) or CPOWER (ceph) signal. This activates the switching regulators on the **d**ata **i**nterface **b**oard (DIB) which then produces the power supply voltages for the CCD sensor.
The IMAGE signal is activated (the exposure button is pressed) to enable clocking of the pixels. Derivation of several CCD clock signals from the TDI clock is done by the pan/ceph sensor. The CLOCK-signal is used to clock out the pixels.

Scanning movement of the unit follows the X-ray beam. The scintillation of the pan/ceph sensor converts radiation to visible light which is detected by the CCD cell. A binning procedure is carried out on individual pixels, i.e. two adjacent pixels in a row and column (2 x 2 binning) forms one large pixel (96µm x 96µm). The output voltage of the CCD is fed to a 14-bit A/D converter.

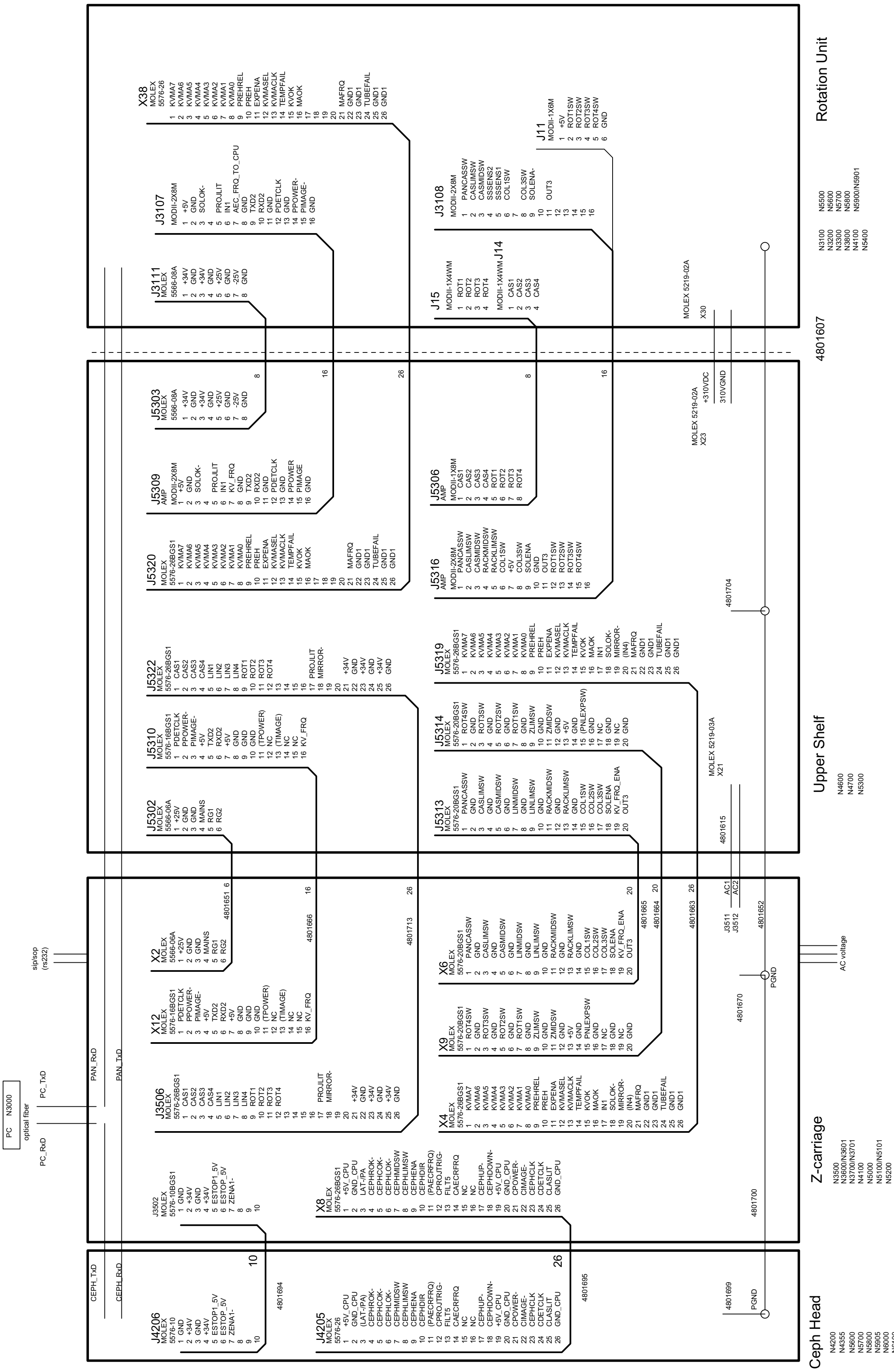
The CCD sensor board sends image data (now 12 bits) to the Data Interface board for differential conversion. In a more noise tolerant shape the image information is transferred to the Terminal board. The Terminal board is a bridge between electrical and optical communication. Parallel format data is converted into serial format. The image information is transferred to the PC via a high speed optical link (160 Mbit/s).

In the PC there is a PCI card with optical interface. Its function is to convert image information back to electrical and parallel format. After this the DICC preprocess the raw image, for example it interpolate gaps between CCD chips, does dark current correction and gain correction (The pixels do not have equal characteristics).

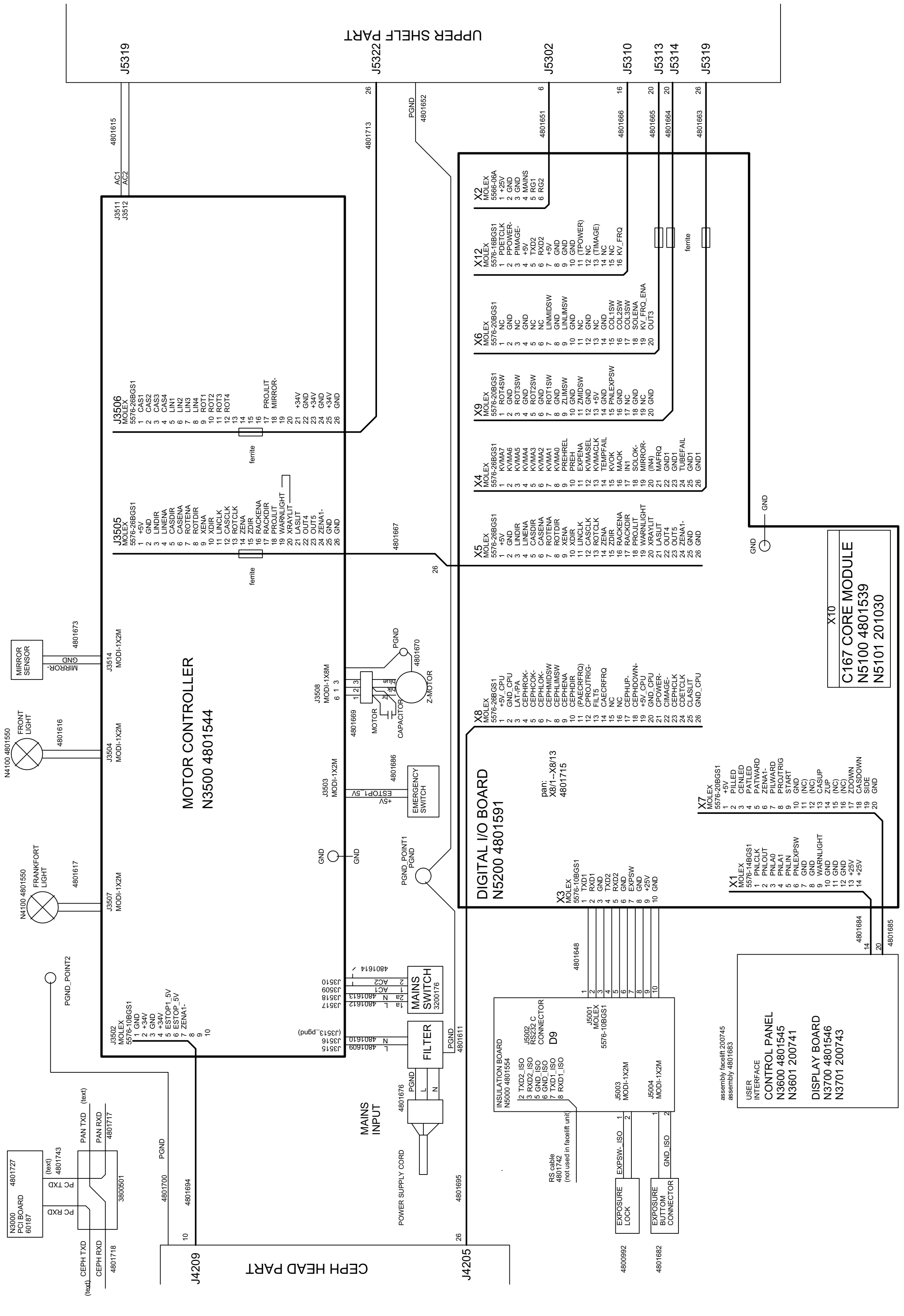
Block Diagram



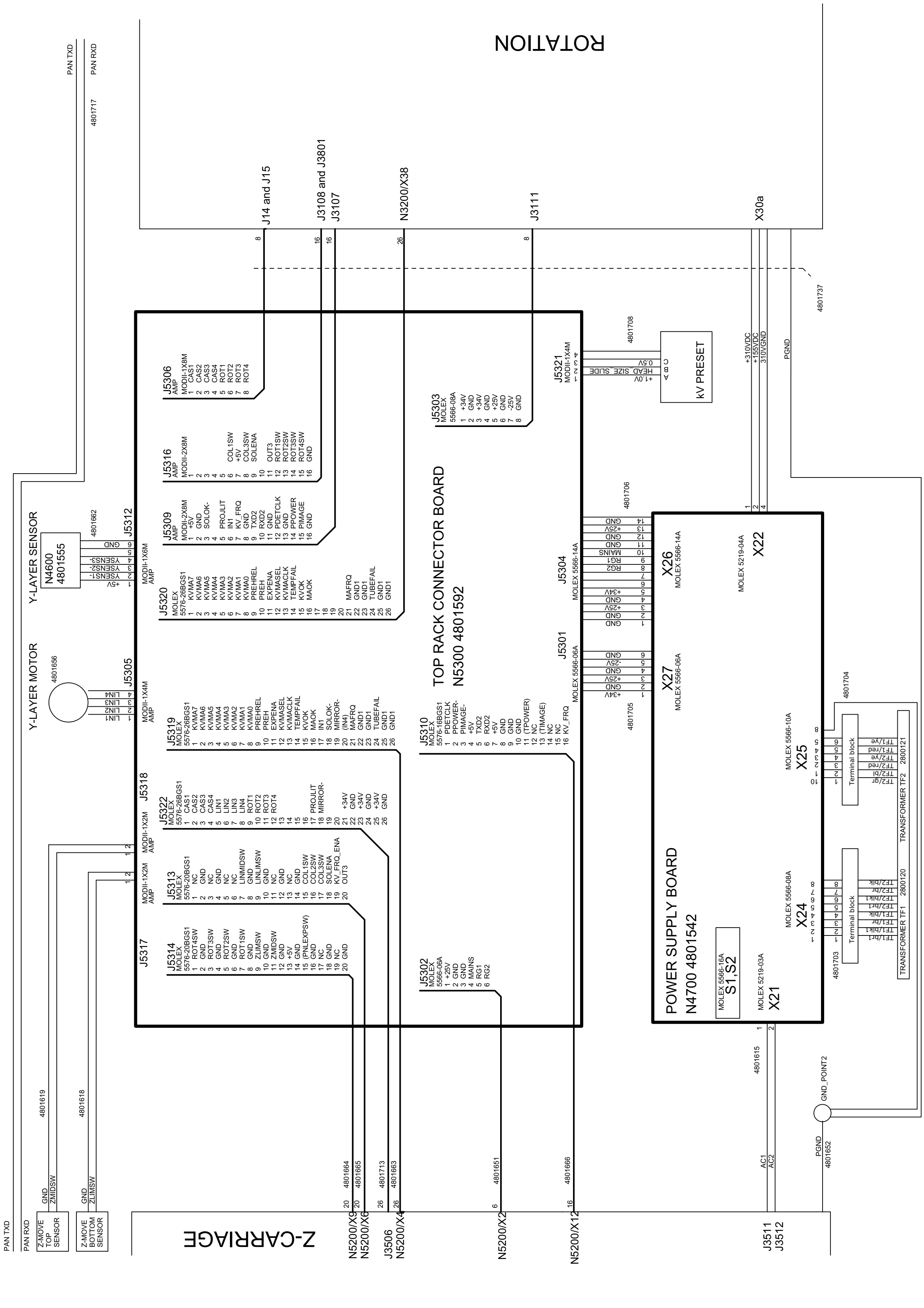
Wiring diagram - general



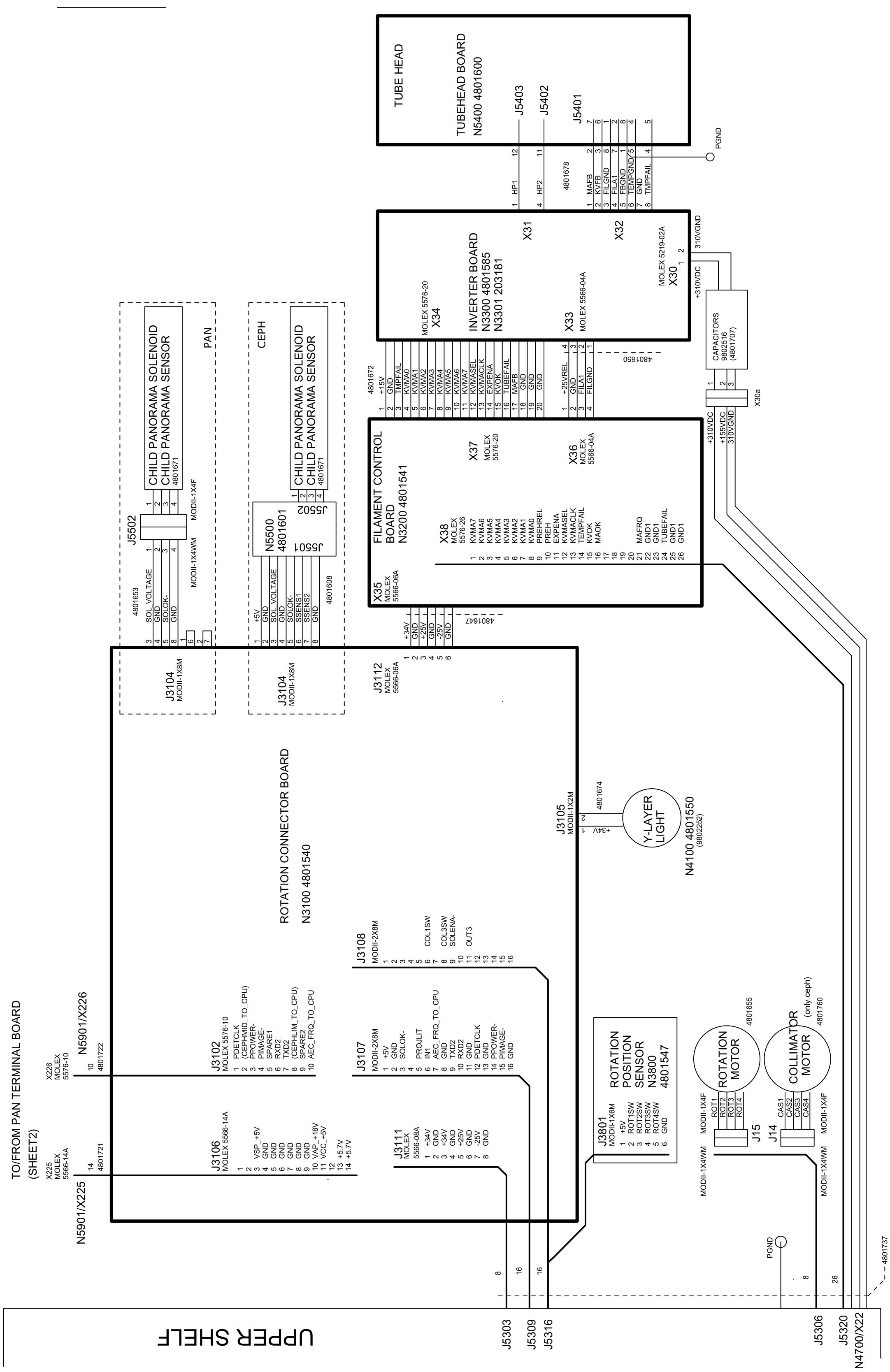
Wiring diagram - Z-carriage



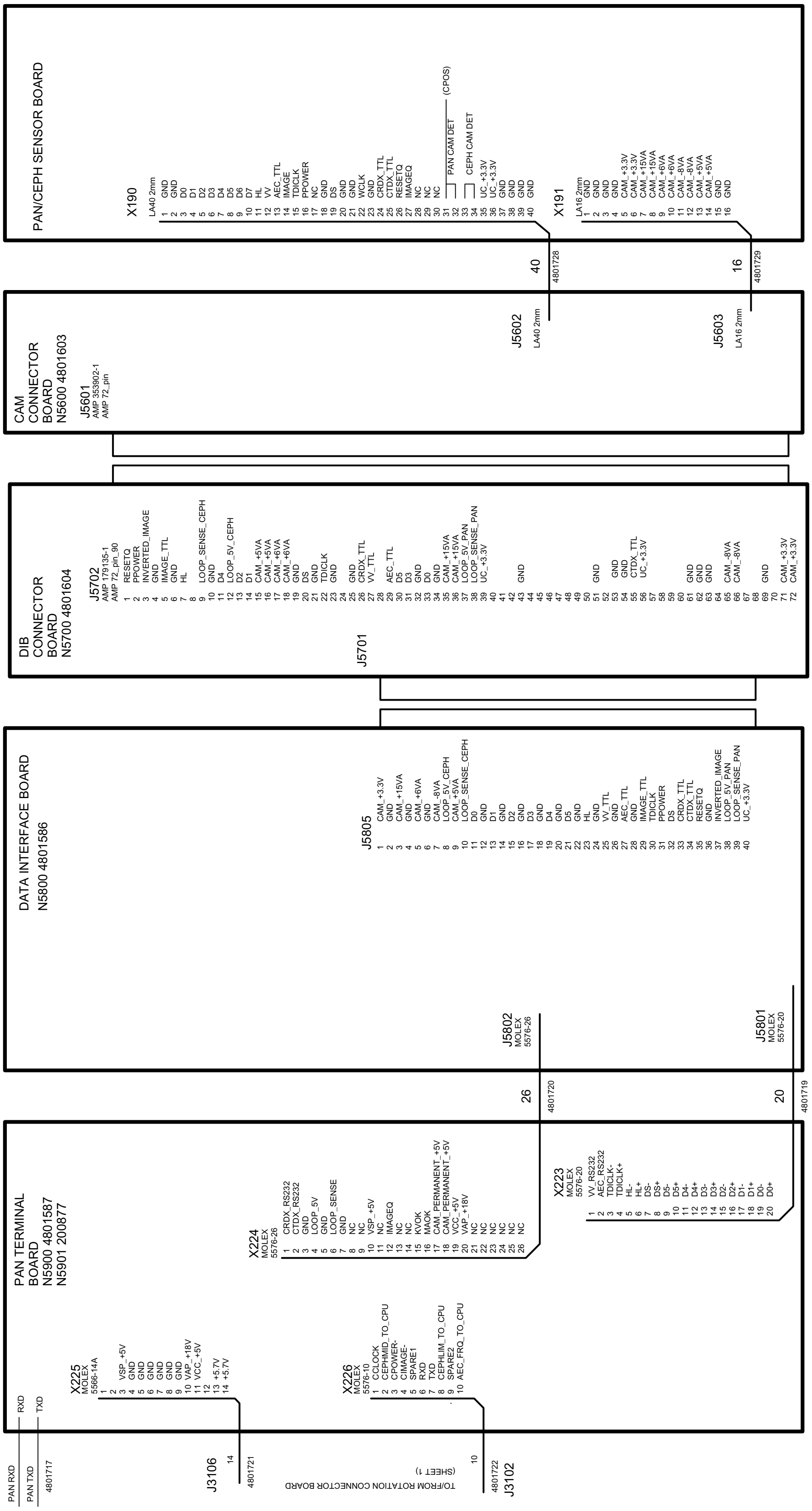
Wiring diagram - upper shelf



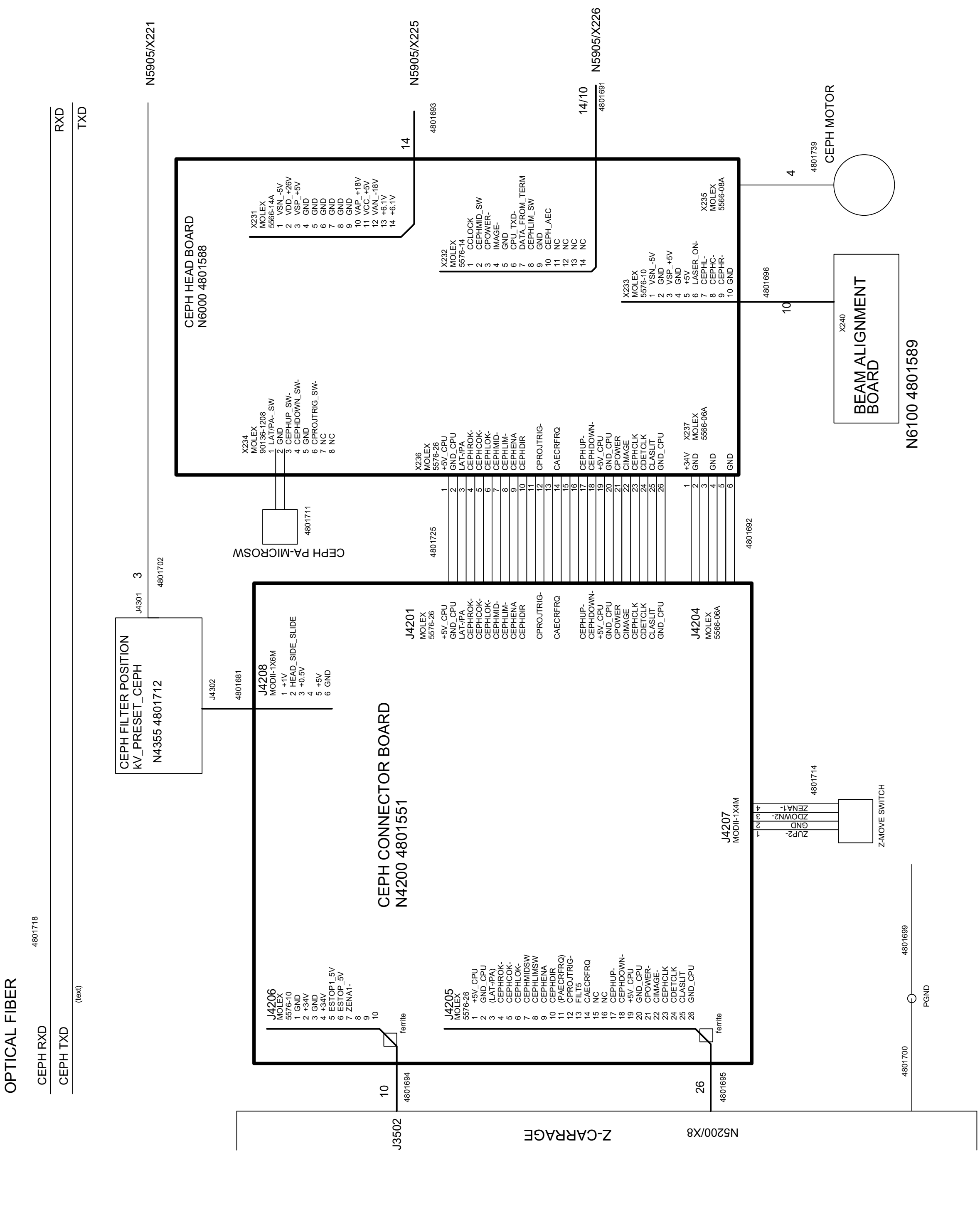
Wiring diagram - rotating unit 1



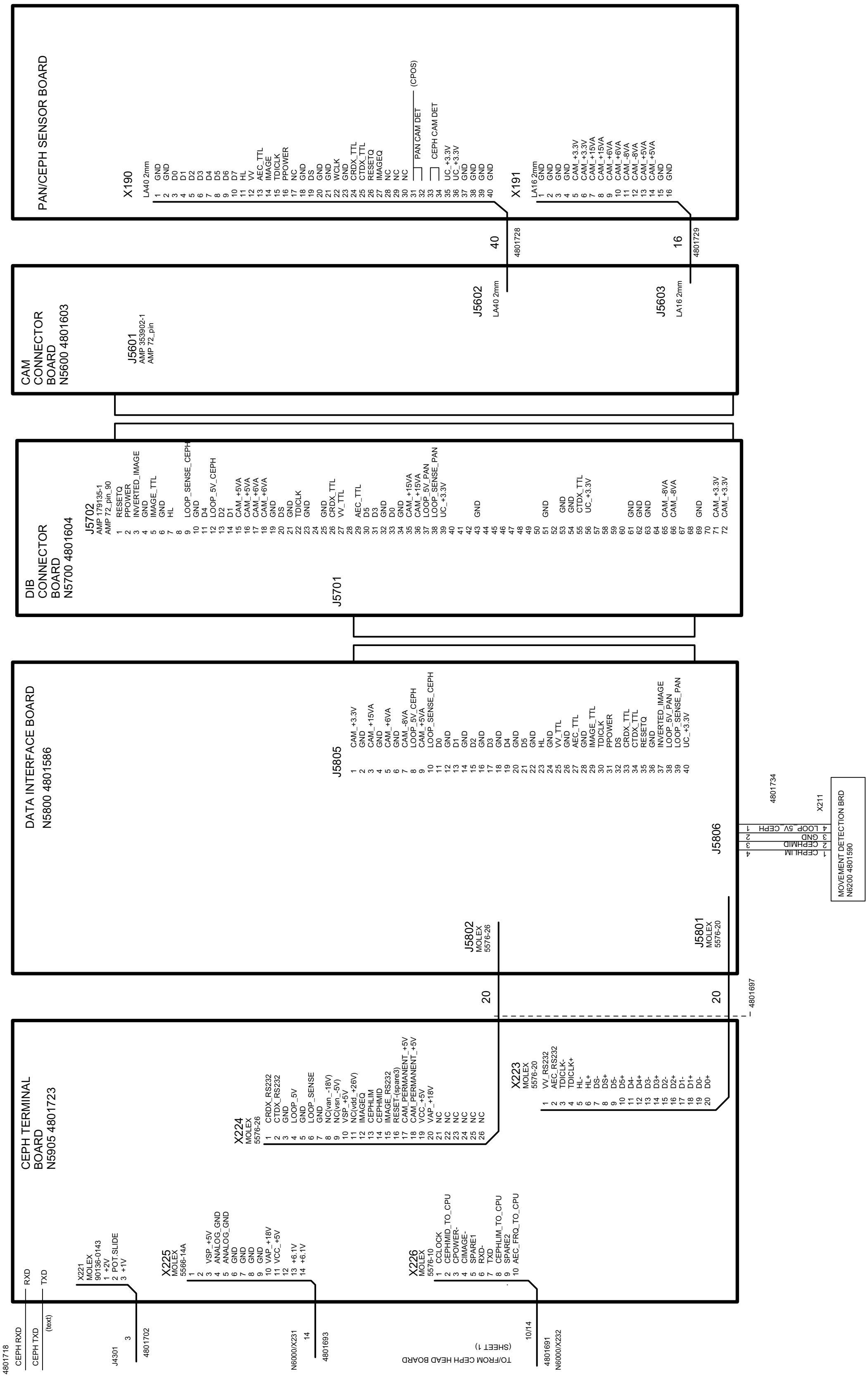
Wiring diagram - rotating unit 2



Wiring diagram - ceph 1



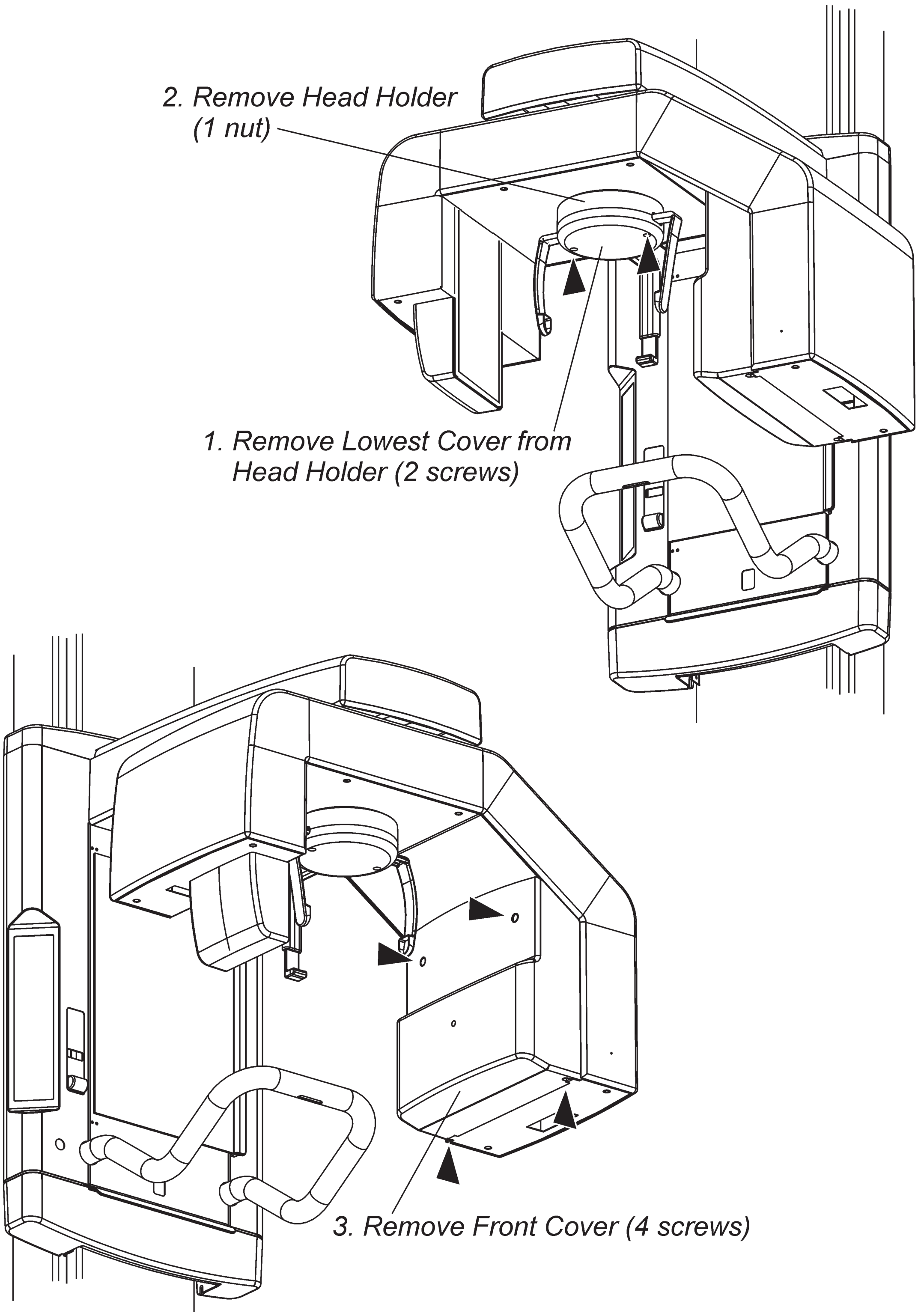
Wiring diagram - ceph 2

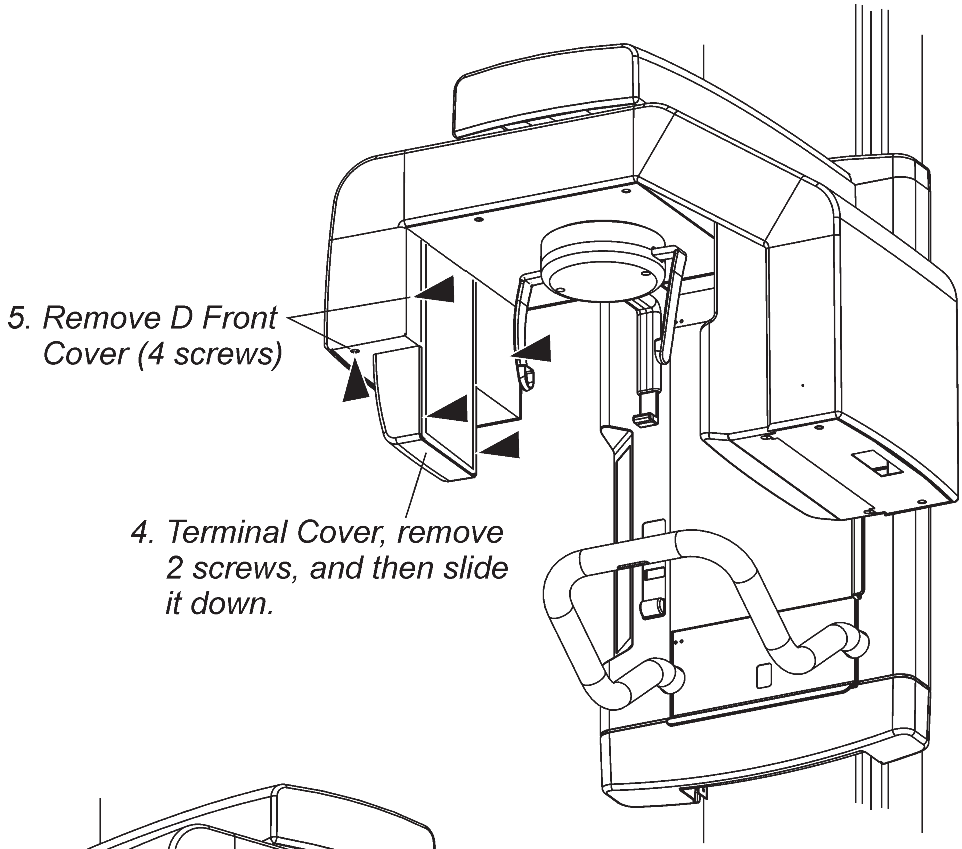


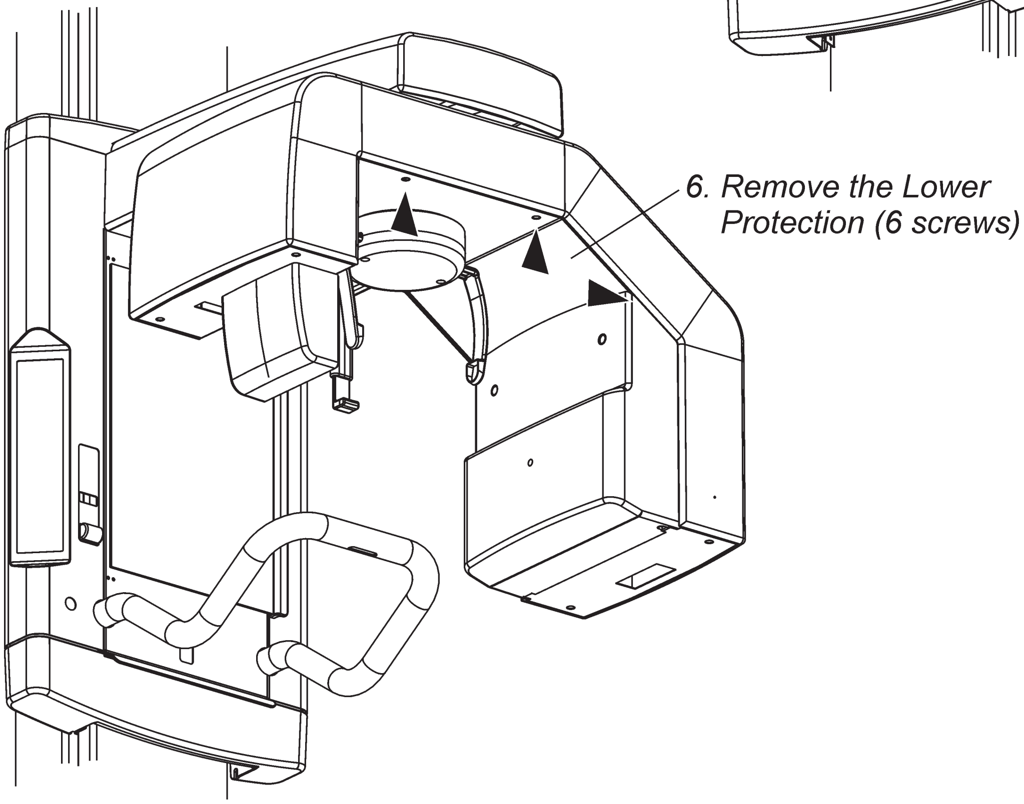
3. Covers and Cover Removal

During repair and and maintentance the unit covers must be removed. This section describes how to remove the covers.

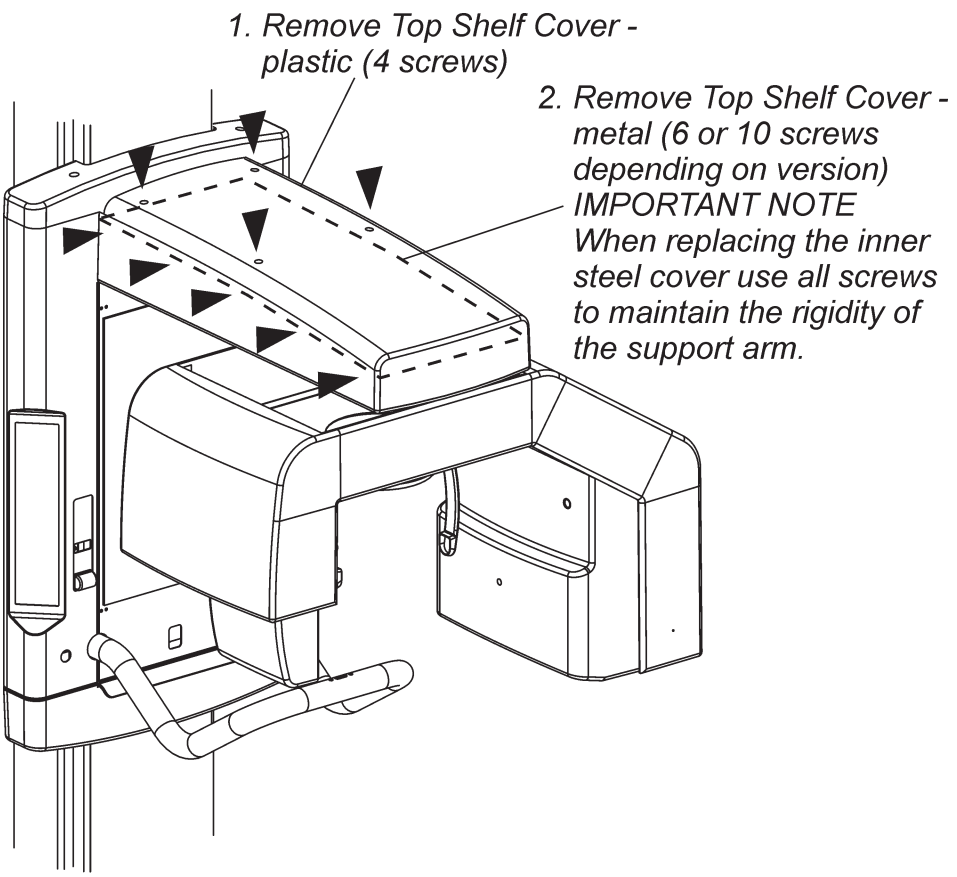
3.1 Rotating unit covers



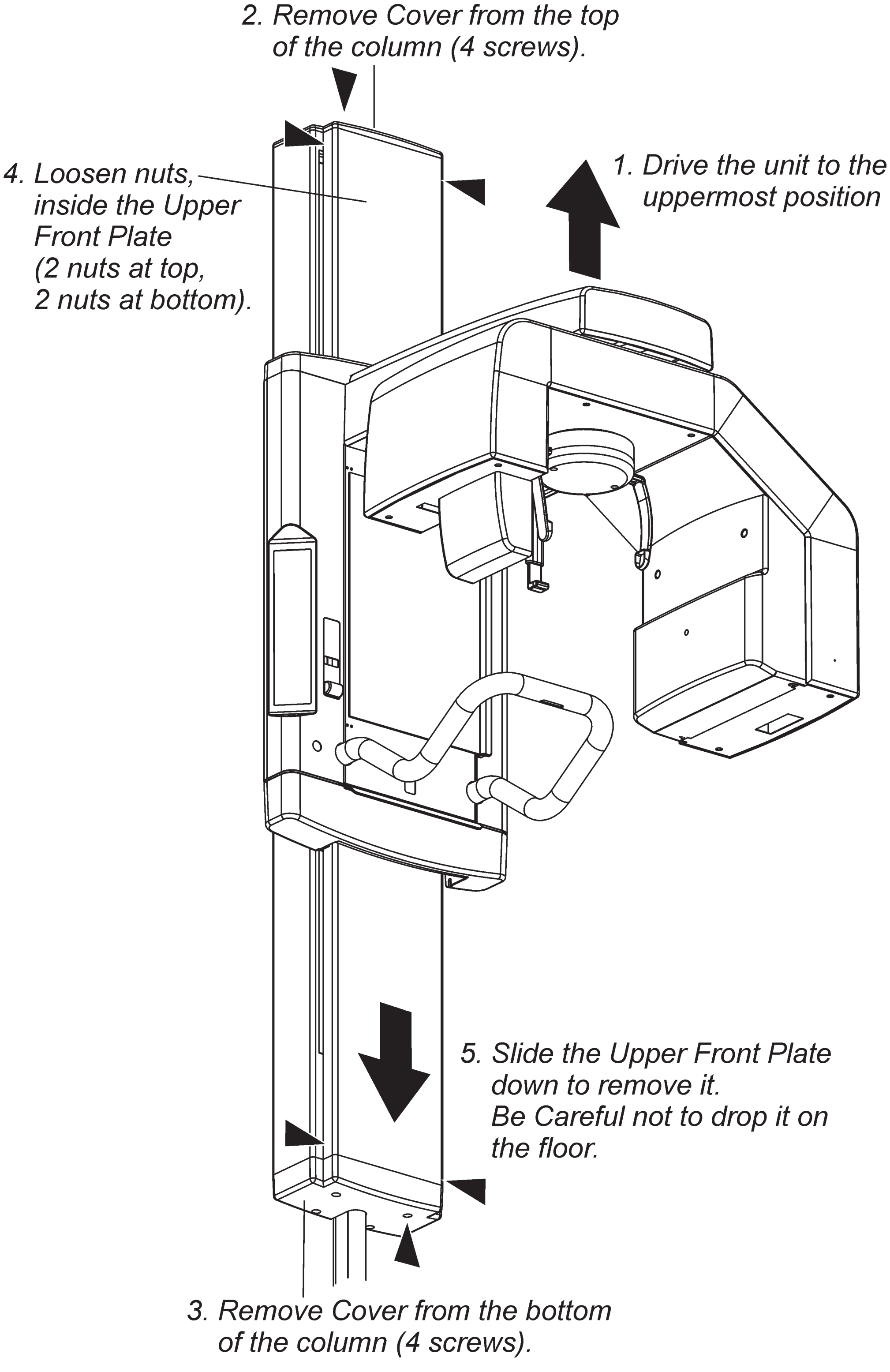

5. Remove D Front Cover (4 screws)
4. Terminal Cover, remove 2 screws, and then slide it down.


6. Remove the Lower Protection (6 screws)

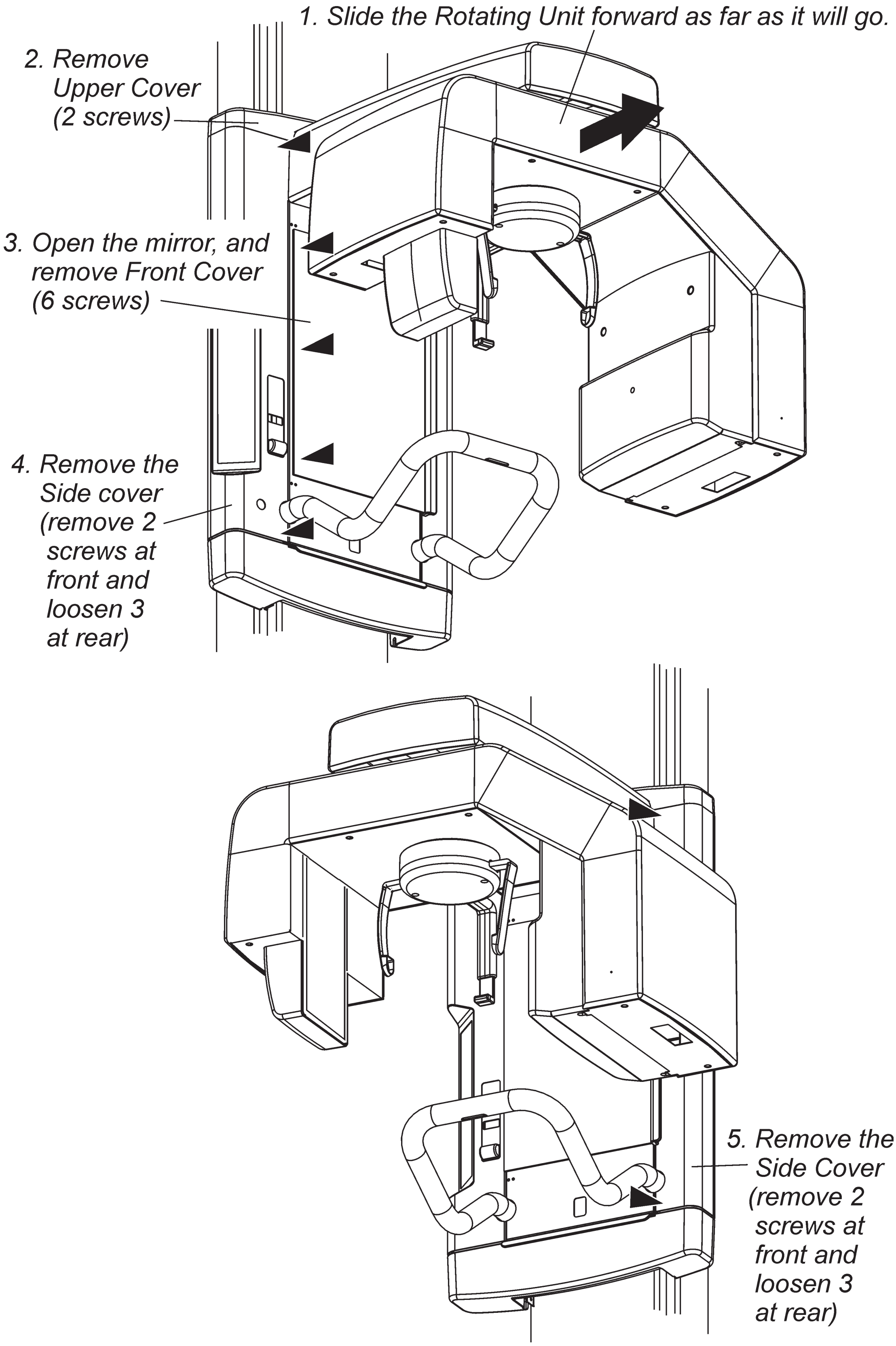
3.2 Support Arm Covers



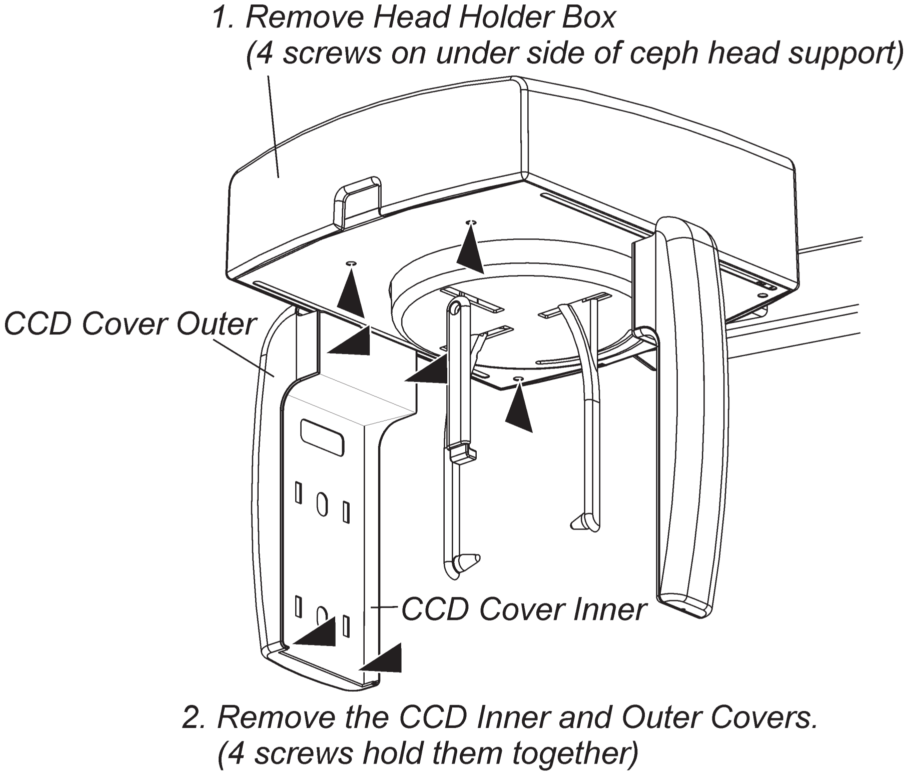
3.3 Column Cover

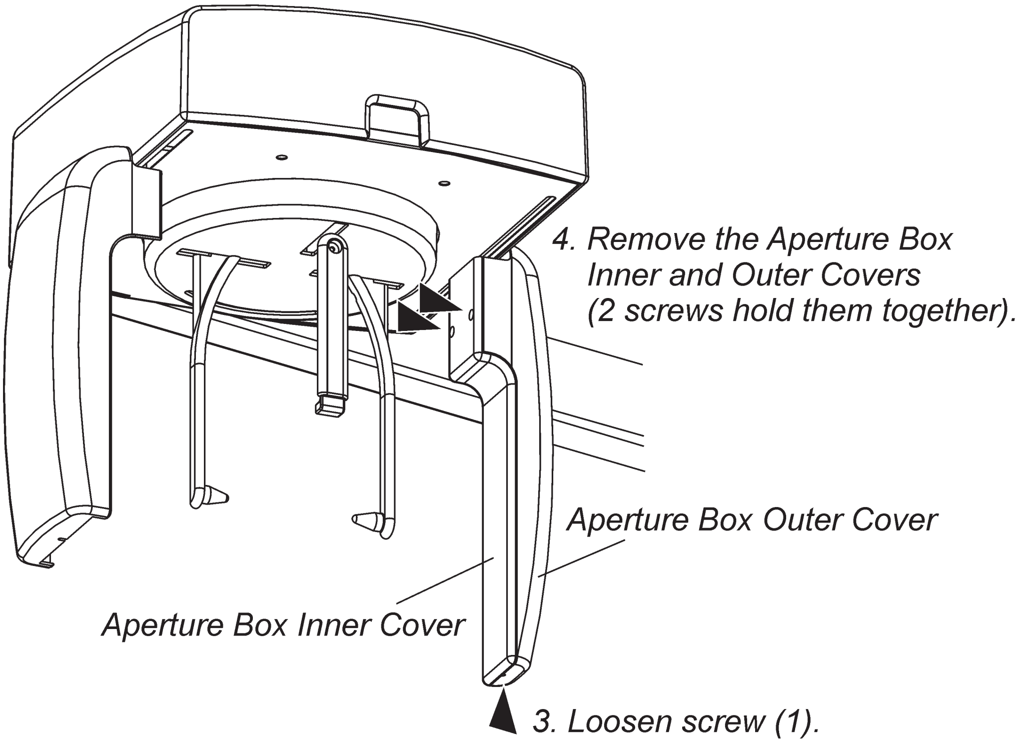


3.4 Z-Carriage Covers



3.5 Ceph Head Covers





4. Service Programs

4.1 Introduction

The service programs allow you to configure the unit settings and to check and test the unit.

There are two types of service program:

- ***Ur*** settings (User settings), these are user preferences and used for configuring the unit during installation and set up.

- ***Sr*** programs (Service programs) programs, these are used for checking and testing the operation of the unit.

The **Ur** settings and **Sr** programs can be accessed either from the unit control panel or the GUI.

Unit versions with s/n B81642 and earlier

Before the service programs can be accessed a Test Connector (SERVICESW 4801744) must be connected to N5200 Digitl I/O board. Only SOREDEX trained service personnel should access the service programs.

IMPORTANT NOTE:
Remember to remove the Test Connector from N5200 Digitl I/O board to prevent unauthorizes persons accessing the service programs

Unit versions with s/n B91643 and later

No Test Connector is required.

4.2 Accessing service programs - s/n B81642 and earlier

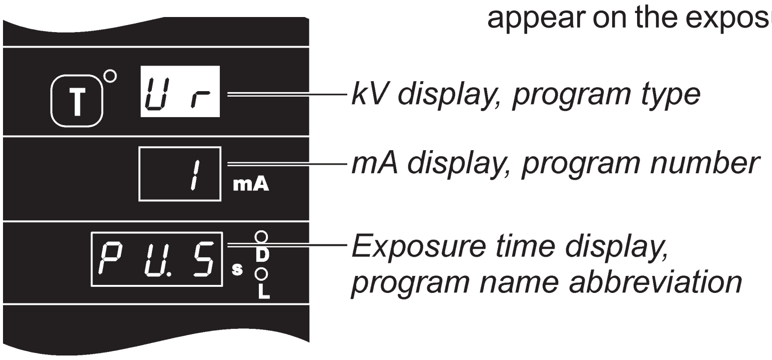
Using the unit control panel

1. Switch the unit off and remove the Z-carriage front cover (6 screws) The cover supports the mirror.

2. Attach the Test Connector (SERVICESW 4801744) to connector X90 on the Digital I/O board (N5200).

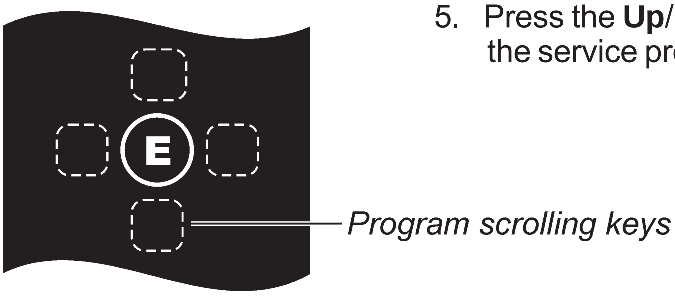
3. Switch the unit on and wait for it to complete the self test. The unit is ready when the LEDs stop flashing and exposure values appear on the control panel displays.

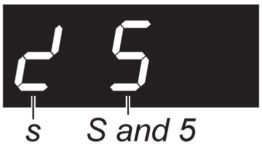
4. Press and hold down the **E**-key until you hear a four beeps and service program code appears on the control panel displays.
   The service program type, ***Ur*** (User settings) or ***Sr*** (Service programs), will appear on the kV-display.
   The service program number will appear on the mA-display and an abbreviation (three characters) of the service program name will appear on the exposure time-display .



The unit is now in the **Service Program** mode.

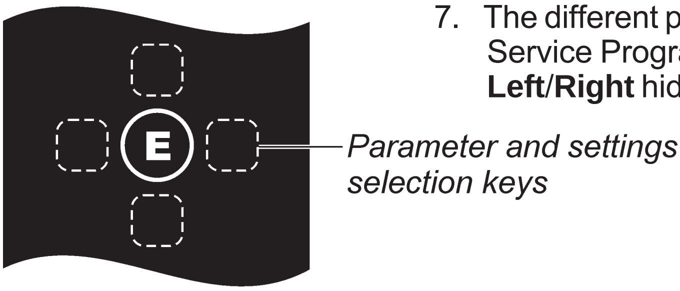
5. Press the **Up**/**Down** hidden keys to scroll through the service programs.





NOTE
Note the segment configurations for the characters ***s***, ***S*** and ***5***.

6. When you reach the required Service Program, briefly press the **E**-key to enter the parameter selection mode for that program.



7. The different parameters or settings for that Service Program can be selected by pressing the **Left**/**Right** hidden keys.

8. When you have selected the required parameter or setting briefly press the **E**-key to return to the Service Program Mode, the Service Program information will reappear on the display.

9. Press and hold down the **E**-key to exit the Service Program Mode and return to the user mode. NOTE: If you switch the unit off BEFORE exiting the Service Program Mode, the new settings will NOT be saved

IMPORTANT NOTE!
Remove the Test Connector from the Digital I/O board (N5200) after use to prevent unauthorized persons accessing the service programs.

Using the GUI

1. Press and hold down simultaneously the **Ctrl**, **Alt**, **Shift** keys and then press the **P** key. The **Service Mode** window will open.

   There are several tabbed pages on the **Service Mode** window that show the configuration of the unit and allow and unit settings to checked and changed.

   NOTE:
   After parameters or settings have been changed, the unit must be restarted for the new parameters or settings to be activated.

   IMPORTANT NOTE!
   Remove the Test Connector from the N5200 Digital I/O board after use to prevent unauthorized persons accessing the service programs.

4.3 Ur Service Programs

Ur 01 PUS - Power Up Settings

Sets the imaging program that will be automatically selected when the unit is switched on. The Test Mode can also be selected.

Using the control panel

1. Select ***Ur 01 PUS*** and press the **E**-key. The LED for imaging program that is automatically selected when the unit is switched on will start to flash.

2. Press the **Left** or **Right** hidden key to select a different imaging program. The LED for the newly selected program will start to flash.

   If you also wish the unit to start in the TEST mode, press **T**-key so the LED comes on.

3. Exit the Service Program mode, and then restart the unit to activate the change.

Using the GUI

1. Click the **Settings** tab.

2. From the **PUS** (*Ur 01 PUS*) list box select the imaging program that you want to be selected whenever the unit is switched on.

   The Options are:
   - Standard (Adult panoramic)
   - Pediatric (Child Panoramic)
   - TMJ
   - Cephalo
   - Film standard (NOT USED)
   - Film pediatric (NOT USED)
   - Film cephalo (NOT USED)

   If you also wish the unit to start in the TEST mode, also click the **Test mode On:** check box to activate it.

3. Click the **Set** button and then restart the unit to activate the change.

Ur 02 rES - Not in use

Ur 03 Arn - Not in use

Ur 04 ASt - Auto Set kV

Selects whether automatic kV selection is activated or not. Refer to the user's manual for more information about automatic kV selection.

Using the control panel

1. Select ***Ur 04 Ast*** and press the **E** key. On the time (s) display either ***OFF*** or ***on*** will appear.

2. Press the **Left** or **Right** hidden key to change the selection.

3. Exit the Service Program mode, and then restart the unit to activate the change.

Using the GUI

1. Click the **Settings** tab.
2. From the **ASt** (*Ur 04 Ast*) list box select either **on** or **OFF**.
3. Click the **Set** button and then restart the unit to activate the change.

Ur 05 bEP - Beeper sound

Selects whether the control panel key tones are activated or not.

Using the control panel

1. Select ***Ur 05 bEP*** and press the **E** key. On the time display either ***OFF*** or ***on*** will appear.
2. Press the **Left** or **Right** hidden key to change the selection.
3. Exit the Service Program mode, and then restart the unit to activate the change.

Using the GUI

1. Select the **Settings** tab.
2. From the **bEP** (*Ur 05 bEP*) list box select either **on** or **OFF**.
3. Click the **Set** button and then restart the unit to activate the change.

Ur 6 CLC - Clear exposure counter

Resets the exposure counter to zero.

Using the control panel

1. Select ***Ur 06 CLC*** and press the **E** key.
   The number of exposures taken since the last time the exposure counter was cleared will appear on the display(s).

2. To reset the exposure counter to zero, after for example, changing the tubehead, press the **Left** hidden key. A **0** will appear on the display.
   NOTE: If you wish to display the number on the exposure counter again, press the **Right** hidden key.

3. Exit the Service Program mode, and then restart the unit to activate any change.

Using the GUI

1. Select the **Counters** tab to display the usage counters.

2. NOTE: Only the **User counter** works correctly.
   To zero the **User counter** or give it a different value, enter 0 or a new value into the text box next to the current counter value.

3. Click the Set button next to the text box and then restart the unit to activate the change.

Ur 7 Err - Last Error

Shows error messages stored in the memory. Only C error messages, except for C1 *** and C 6 EEP, are stored in the memory.
NOTE: New units may have error messages in the memory. This is not abnormal.

Using the control panel

1. Select ***Ur 07 Err*** and press the **E** key. The Last error message will appear on the display.
   If there are no error codes stored in the memory, three dashes, ———, will appear on the display.

Using the GUI

1. Click the **Counters** tab to display the error counters and the Last error.

4.4 Sr Service Programs

Sr10 InS - Install program

The functions in this program are used during unit installation and when checking the x-ray beam alignment.
NOTE:
The functions in this program are only active when the power is on. When the power is switched off the unit will return to the normal (program OFF) mode.

Using the control panel

1. Select ***Sr 10 InS*** and press the **E** key. The text OFF will appear on the display.

2. Press the left or right hidden key to select the required function.

   The functions are as follows:

Mode	Function
OFF	Normal operation. Default setting when the unit is switched on.
nPc	No PC check (no fibre optic connection) Exposures can be taken even if the PC is not in the image receiving mode (i.e. the Image Capture button in DfW does not need to be pressed). This function will also work if the PC is not connected. Imaging programs and techique factors can be selected as in the user mode. NOTE: This function is is useful in situations, such as exhibtions, where there is no optical cable connection to the PC.
nCo	No collimator check. No collimator check when taking and exposure.
nCs	Not in use.
nCh	No checks at all. Exposures can be taken without without the collimator position being checked. Also the 15 s wait period between exposures is not monitored. Imaging programs and technique factors can be selected as in the user mode.
nrA	Disables x-rays. No HW feedback.
non	Disables all the above checks and x-rays. (nCh and nrA combined).

Using the GUI

1. Click the **Settings** tab.
2. From the **Ins** (*Sr 10 Ins*) list box select the required function.
   The functions are listed above in the "Using the control panel".

Sr 11 EPS - eps program

WARNING: X-rays are generated when this program is used.
When this program is selected the stepper motors do not operate and exposures can be taken with unit movements. This program is used during alignment, electrical troubleshooting and calibration.
NOTE
When this program is selected, the kVOK and mAOK signals are not monitored. Therefore C4 Inu and C5 FIL error codes are not enabled. Only the C3 gEn error code is monitored.

Using the control panel

1. Select ***Sr 11 EPS*** and press the **E** key. The current technique factors will appear on the display.

2. Press the left or right hidden key to select the different technique factors, kV, mA and exposure time.

3. Test exposures can now be taken, but there are no imaging movements during the exposure.

4. IMPORTANT Exit programming without switching the power off.

Using the GUI

1. Select the **Settings** tab.

2. Click the **EPS** (*Sr 11 EPS*) radio button to activate it.

3. From the list box select the program type. The options are:
   - Still panoramic
   - Still Cephalo
   - No movement (panoramic)
   - No movement cephalo.

Preselected technique factors for the selected option will appear in the **Imaging Parameters** group box.

4. If you wish to change the preselected technique factors enter new values in the appropriate fields in the **Imaging Parameters** group box (press the up/down keys to change the time), and press the **Set** key.

5. Test exposures can now be taken, but there are no imaging movements during the exposure.

6. IMPORTANT Exit programming without switching the power off.

Sr 12 PUP - Warmup program

WARNING: X-rays are generated when this program is used.
This program is used to:
- determine if the tube head assembly is defective.
- warm up a replacement of tube head.

It is also recommended that this program is used to warm up the tube head of any unit that has not been used for 3 months or more.

Using the control panel

1. Select ***Sr 12 PUP*** and press the **E** key. Technique factors ***20kv***, ***5.0mA*** and ***3.2s*** will appear on the display.

2. Protect yourself from radiation and and take an exposure. After the exposure the kV will automatically increase to the next level.

3. Immediately take another exposure at the new value.

4. Continue to take exposures each time the kV value increases. You do not have to wait between exposures.
   When the maximum kV value is reached the mA value will start to increase. Continue to take exposures until until the maximum technique factors are reached, ***85kV*** and ***10mA*** and the text ***End*** appear on the display

NOTE: If the tube arcs or malfunctions during an exposure the program will be terminated and an error message will appear.
Clear the error message and restart the test by pressing the **E** key twice.
If arcing and/or malfunctions occur repeatedly check the **kV and mA references at PUP**. This is described after **Using the GUI**.

5. After completing the test, exit the service program, set the unit for normal operation and take a panoramic exposure using the maximum technique factors to check that the unit is functioning correctly.

Using the GUI

1. Click the **Settings** tab.

2. Click the **PUP** (*Sr 12 PUP*) radio button to activate it.

3. Click the **Select** key.
   Technique factors ***20kv***, ***5.0mA*** and ***3.2s*** will appear in the **Imaging Parameters** field.

4. Now follow the same procedure, steps 2 to 5, as described in Using the control panel.

Checking the kV/mA Feedback Reference Voltages

Checking the kV/mA Feedback Reference Voltages at PUP is done as follows:

To check the kV feedback reference voltage connect the +ve probe of a multimeter to TP 19 on N3300 and the -ve prove to GROUND.

To check the mA feedback reference voltage connect the **+** probe of a multimeter to TP 4 on N3200 and the **-** probe to GROUND.

Carry out the test described previously. The kV/mA Feedback Reference Voltages at PUP are listed below:
NOTE
The tolerance of the VkVref is ±0.18 and the tolerance of the VmAref is ± 10%.

KV	mA	s	(VkVref)	(VmAref)
20	5.0	3.2	(1.00 V)	(1.22 V)
30	5.0	3.2	(1.50 V)	(1.22 V)
40	5.0	3.2	(2.00 V)	(1.22 V)
50	5.0	3.2	(2.50 V)	(1.22 V)
54	5.0	3.2	(2.70 V)	(1.22 V)
57	5.0	3.2	(2.85 V)	(1.22 V)
60	5.0	3.2	(3.00 V)	(1.22 V)
63	5.0	3.2	(3.15 V)	(1.22 V)
66	5.0	3.2	(3.30 V)	(1.22 V)
70	5.0	3.2	(3.50 V)	(1.22 V)
73	5.0	3.2	(3.65 V)	(1.22 V)
77	5.0	3.2	(3.85 V)	(1.22 V)
81	5.0	3.2	(4.05 V)	(1.22 V)
85	5.0	3.2	(4.25 V)	(1.22 V)
85	6.0	3.2	(4.25 V)	
85	6.5	3.2	(4.25 V)	
85	7.2	3.2	(4.25 V)	
85	7.7	3.2	(4.25 V)	
85	8.0	3.2	(4.25 V)	(1.94 V)
85	8.5	3.2	(4.25 V)	
85	9.0	3.2	(4.25 V)	
85	9.5	3.2	(4.25 V)	
85	10.0	3.2	(4.25 V)	(2.43 V)

Sr 13 Prh - Preheat program

WARNING: X-rays are generated when this program is used.
This program automativally sets the preheat level of the tube head filament.
This must be done when the tube head or Filament board are changed.
The preheat level can also be set manually.

Using the control panel

1. Select ***Sr 13 Prh*** and press the **E** key. On the control panel displays numbers will appear:
   73 on the kV display,
   10 on the mA display,
   1 (not calibrated), or **xxx** (the last set preheat level), on the exposure values display.

2. Protect yourself from radiation and press and hold down the exposure button to take an exposure.
   During the exposure, the preheat level will start to rise. At the same time the unit will also check the mA value.
   When the desired mA value is reached the program will automatically stop the exposure.
   The new preheat level is usually between 80 and 120.

3. Press the **E** key to store the preheat level in the EEPROM.

4. Press hold the **E** key to exit the service mode and save the preheat level.

Using the GUI

1. Click the **Settings** tab.

2. Click the **Prh** (*Sr 13 Prh*) radio button to activate it.

3. Protect yourself from radiation and press and hold down the exposure button to take an exposure. During the exposure, the preheat level will start to rise. At the same time the unit will also check the mA value.
   When the desired mA value is reached the program will automatically stop the exposure.
   The new preheat level is normally between 80 and 120 and will apear in the active text box next to the **Prh** radio button.

4. Click the **Set** button to store the preheat level in the EEPROM.

5. Press hold the **E** key to exit the service mode and save the preheat level.

Manually selecting the Preheat level

1. Select the **Settings** tab.

2. Click the **Prh** (*Sr 13 Prh*) radio button to activate it.

3. In the empty text box next to the **Set** key, key in the preheat level you require.

4. Click the **Set** button to store the preheat level in the EEPROM.

Sr 14 FrE - Head/nasion support frequencies

This service program displays the frequency information that corresponds to the position of the panoramic head supports and the positions of the cephalometric head and nasion support.
This service program can only be accessed using the control panel.

Using the control panel only

1. Make sure that the fibre optic link is active.

2. Select ***Sr 14 Fre*** and press the **E** key. The frequency, in kHz, will appear on the display.

3. Press the up or down hidden key to select the kV or mA displays and then the left or right hidden key to select the option. The options are:
   - **na**, nasion support frequency
   - **HE**, head support frequency
   - **PA**, panoramic head support frequency
   - **CE**, cephalometric head support frequency

   NOTE:
   If **na** and **PA** are select no value will appear on the display as the position of the nasion support (nA) on the panoramic head support (PA) is not monitored.

   When the nasion / head supports are manually moved the frequencies will change. The frequencies ranges are shown below:

Cephalometric nasion (CE + nA)	700 - 3400 Hz (±100 Hz)
Cephalometric head support (CE + HE)	2100 - 4000 Hz (±100 Hz)
Panoramic head support (HE + PA)	2100 - 4000 Hz (±100 Hz)
(nA + PA)	- - -

To adjust the frequencies refer to:
N4200 for cephalometric head support
N5300 for panoramic head support
N5905 for cephalometric nasion.

Sr 15 SUP - line voltage check

Displays the the line voltage. The line voltage is monitored by measuring the incoming +25V supply on the Filament Control Board.
This service program can only be accessed using the control panel.

Using the control panel only

1. Select ***Sr 15 SUP*** and press the **E** key. The voltage will appear on the time display.

2. Press the **E** key to return to the service program mode.

Sr 16 Clr - Not in use

Sr 17 CEP - Not in use

Sr 19 POS - Not in use

Sr 20 dnL - sw download program

This program allows the CPU to be switched so that it can download SW from the PC terminal program.
If this program is started accidentally turn the unit off, wait few seconds and then turn it on again. The unit should start normally.

Instructions on how to download software are in Section **5.1 Downloading software from a PC**.

I/O check program

This program allows the states of the CPU inputs and outputs to be checked without removing covers from the unit.
It is useful when trouble shooting CPU input signal problems, eg. the various micro switches and optocouplers.
The program shows whether or not signals from switches reach the CPU.
This service program can only be accessed using the GUI.

Using the GUI only

1. Select the **I/O ports** tab. The window shows the signals to and from the CPU.

   The signals are as follows:

SPI out 0

0	Proj Lit	Projector light enable (lights off)
1	Solena-	Child aperture solenoid enable
2	KV_frq_ena	Pan head width freq. enable (Auto kV)
3	n/a	Not used
4	n/a	Not used
5	n/a	Not used
6	n/a	Not used
7	n/a	Not used
8	n/a	Not used
9	n/a	Not used
10	n/a	Not used
11	n/a	Not used
12	Z Dir	Z-carriage (0=up, 1=down)
13	Z Ena	Z-carriage movement enable (1)
14	n/a	Not used
15	n/a	Not used

SPI out 1

0	Cas Dir	Collimator direction
1	Cas Ena	Collimator movement enable
2	Rot Dir	Rotation movement direction
3	Rot Ena	Rotation movement enable
4	Ceph Dir	Cepd CCD direction
5	Ceph Ena	Cepd CCD enable
6	Lin Dir	Linear movement direction
7	Lin Ena	Linear movement enable
8	P Power	Pan CCD power on
9	P Image	Pan CCD image capture on
10	C Power	Ceph CCD on
11	C Image	Ceph CCD capture on
12	n/a	Not used
13	n/a	Not used
14	Clas Lit	Ceph head width freq. enable (Auto kV)
15	n/a	Not used

Port 5

0	Exp Sw	Exposure switch (pressed)
1	Instru	R & D jumper installed
2	Ma OK	Tube current OK
3	n/a	Not used
4	Exh Sw	Option (exhibition) switch on
5	In 3	Mirror (1=closed)
6	Mains	N4700 S1 or S2 (S1=1, S2=0)
7	In 2	Child solenoid on
8	Tube Fail	Tube head high voltage breakdown. (no breakdown)
9	n/a	Not used
10	n/a	Not used
11	n/a	Not used
12	Lin Mid Sw	Linear (Y) movement position
13	Lin Lim Sw	Linear (Y) movement position
14	Sec. Slit Mid Sw	Secondary slit position
15	Sec. Slit Mid Sw	Secondary slit position

Port 6

0	Flash	Flash
1	Sram	SRAM
2	n/a	Not Used
3	n/a	Not Used
4	WD	Watchdog
5	E2Prom CS	EEProm chip select
6	SPI CS 1	SPI chip select
7	n/a	Not used
8	n/a	Not used
9	n/a	Not connected
10	n/a	Not connected
11	n/a	Not connected
12	n/a	Not connected
13	n/a	Not connected
14	n/a	Not connected
15	n/a	Not connected

SPI in 0

0	n/a	Not Used
1	n/a	Not Used
2	Pil Ward	Y-movement to left (towards the column)
3	Zena	Zena (from z-buttons)
4	Yforw	Y-movement to right
5	Temp Fail	Tube head temperature switch
6	Service Sw	Service switch
7	n/a	Not Used
8	S sens1	Collimator position (same as SSens 1)
9	S sens2	Collimator pos. (SSens 2 or gnd)
10	S sens2	Collimator pos (SSens 2)
11	n/a	Not used
12	Return	Return button
13	n/a	Not used
14	Z Down	Z-carriage DOWN button
15	Z Up	Z-carriage UP button

SPI in 1

0	Ceph Lok	Ceph ccd position		
1	Ceph Cok	Ceph ccd position		
2	Ceph Rok	Ceph ccd position		
3	Ceph Lat Pa	Ceph patient head position		
4	Ceph L	No ceph or ceph on the left (ceph on the left)		
5	Ceph R	No ceph or ceph on the right (ceph on the right)		
6	n/a	Not used		
7	n/a	Not used		
8	Rot 1 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 1	1	1	1
9	Rot 2 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 2	1	0	0
10	Rot 3 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 3	0	0	0
11	Rot 4 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 4	1	0	1
12	Z Mid Sw	Z-carriage in upper limit		
13	Z Lim Sw	Z-carriage in either limit		
14	Ceph Mid Sw	Ceph movement detector (start or end) n)		
15	Ceph Lim Sw	Ceph movement detector (in the middle)		

CP Buttons

0	CP Button OK	Control panel OK button
1	CP Button R	Control panel Right button
2	CP Button L	Control panel Left button
3	CP Button D	Control panel Down button
4	CP Button U	Control panel Up button
5	CP Button T	Control panel Test button
6	n/a	Not used
7	n/a	Not used
8	n/a	Not used
9	n/a	Not used
10	n/a	Not used
11	n/a	Not used
12	n/a	Not used
13	n/a	Not used
14	n/a	Not used
15	n/a	Not used

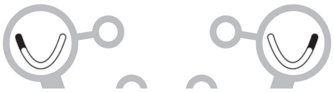
4.5 Accessing the service programs - s/n B91643 and later

Using the unit control panel

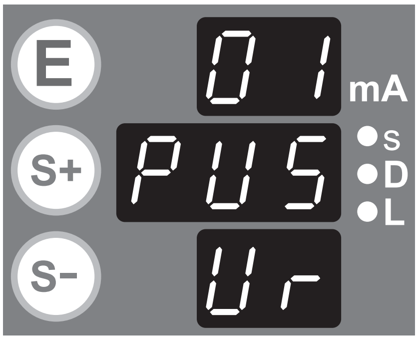
1. Make sure that the unit and PC are on.

2. You can access either the **Ur** settings only or both the **Ur** settings and **Sr** programs.

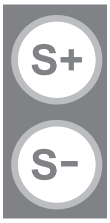
To access the **Ur** settings press and hold down the **E**-key until you hear four beeps and the letters **Ur** appear on the info display. You are now in the **Ur** settings mode.



To access the both the **Ur** settings and **Sr** programs, make sure that you are in the **Ur** settings mode (described above), and then press and hold down the **left partial panoramic** key and then press and hold the **right partial panoramic** key.
Release the **left partial panoramic** key and then the **right partial panoramic**. You will hear an audible signal which indicates that the unit is now in the combined **Ur** setting and **Sr** programs mode.



In both modes the setting/program numbers will appear on the mA-display and an abbreviation of the setting/program name (three characters) will appear on the exposure values display.



3. Press the **Ceph exposure time selection** keys to scroll through the settings/programs.

4. When you reach the setting/program you wish to change, briefly press the **E**-key to enter the mode where the setting/program can be changed.
   The changes that can be made are described in, **4.6 Ur Settings** and **4.7 Sr Programs**.

5. When you have changed the setting/program briefly press the **E**-key to return to the unit settings mode.

6. Press and hold down the **E**-key to exit the settings/programs mode and return to the user mode.

Using the GUI

1. Make sure that the GUI is active.

2. Press and hold down simultaneously the **Ctrl**, **Alt**, **Shift** keys and then press the **P** key. The **Service Mode** window will open.

   There are several tabbed pages on the **Service Mode** window that show the configuration of the unit and allow and unit settings to checked and changed.

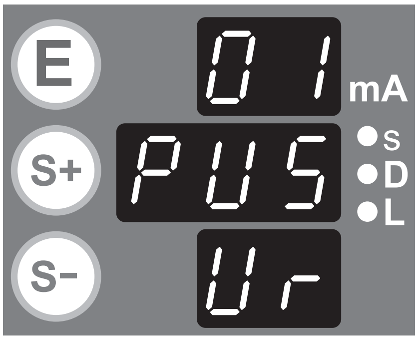
   NOTE:
   After parameters or settings have been changed, the unit must be restarted for the new parameters or settings to be activated.

4.6 *Ur* Settings

Ur 01 PUS - Power Up Settings

Sets the imaging program and kV value that will be automatically selected when the unit is switched on.

Using the control panel



1. Select ***01 PUS*** and press the **E**-key to enter the mode where the setting can be changed.

2. Select the imaging program and kV value that you want to be selected when the unit is switched on. If you want the unit to start in the TEST mode, press the **T**-key.

3. Press the **E**-key to accept the new imaging program and kV value. Press and hold down the **E**-key to exit the unit settings mode. The new settings will be used the next time the unit is restarted.

Using the GUI

1. Click the **Settings** tab.

2. From the **PUS** (*Ur 01 PUS*) list box select the imaging program that you want to be selected whenever the unit is switched on.

The Options are:
- Standard (Adult panoramic)
- Fast standard
- Pediatric (Child Panoramic)
- Fast Pediatric
- TMJ
- Cephalo

If you also wish the unit to start in the TEST mode, also click the **Test mode On:** check box to activate it.

3. Click the **Set** button and then restart the unit to activate the change.

Ur 02 rES - Not in use

Ur 03 Arn - Not in use

Ur 04 ASt - Auto Set kV

Selects whether automatic kV selection is activated or not. It is recommended that this setting is left on. Refer to the user's manual for more information about automatic kV selection.

Using the control panel

1. Select ***04 ASt*** and press the **E** key.
   The current setting, either **on** (automatic kV is selected) or **OFF** (automatic kV is not selected), will appear on the exposure values display.

2. Press the appropriate upper **Partial panoramic** key to change the setting.

3. Press the **E**-key to accept the new setting and then press and hold down the **E**-key to to return to the user mode.

Using the GUI

1. Click the **Settings** tab.
2. From the **ASt** (*Ur 04 Ast*) list box select either **on** or **OFF**.
3. Click the **Set** button and then restart the unit to activate the change.

Ur 05 bEP - Beeper sound

Selects whether the control panel key tones are on or off.

1. Select ***05 bEP*** and press the **E** key.
   The current setting, either **on** (key tones on) or **OFF** (key tones off), will appear on the exposure values display.

2. Press the appropriate upper **Partial panoramic** key to change the setting.

3. Press the **E**-key to accept the new setting and then press and hold down the **E**-key to to return to the user mode.

Using the GUI

1. Select the **Settings** tab.
2. From the **bEP** (*Ur 05 bEP*) list box select either **on** or **OFF**.
3. Click the **Set** button and then restart the unit to activate the change.

Ur 6 CLC - Clear exposure counter

Resets the exposure counter to zero.

Using the control panel

1. Select ***06 CLC*** and press the **E** key.
   The number of exposures taken since the last time the exposure counter was cleared will appear on the display(s).

2. Press either **Partial panoramic** -key to clear the exposure counter. The number 0 will appear on the display.
   If you press either **Partial panoramic** -key a second time, the the original exposure number will reappear.

3. Press the **E**-key to accept the change and then press and hold down the **E**-key to to return to the user mode.

Using the GUI

1. Select the **Counters** tab to display the usage counters.

2. To zero a counter or give it a different value, enter 0 or a new value into the text box next to the current counter value.

3. Click the **Set** button next to the text box and then restart the unit to activate the change.

Ur 7 Err - Last Error

Shows error messages stored in the memory. Only C error messages, except for C1 *** and C 6 EEP, are stored in the memory.
NOTE: New units may have error messages in the memory. This is normal.

Using the control panel

1. Select ***07 Err*** and press the **E** key. The Last error message will appear on the display.
   If there are no error codes stored in the memory, three dashes, **———**, will appear on the display.

2. Press the **E**-key to return to the user settings mode and then press and hold down the **E**-key to to return to the user mode.

Using the GUI

1. Click the **Counters** tab to display the **Error counters** and the **Last error**.

4.7 Sr Programs

Sr10 InS - Install program

The functions in this program are used during unit installation and when checking the x-ray beam alignment.
NOTE:
The functions in this program are only active when the power is on. When the power is switched off the unit will return to the normal (program OFF) mode.

Using the control panel

1. Select ***Sr 10 InS*** and press the **E** key. The text OFF will appear on the display.

2. Press the appropriate upper **Partial panoramic** key to select the required function.

The functions are as follows:

Mode Function

OFF Normal operation. Default setting when the unit is switched on.

nPc No PC check (no fibre optic connection)

Exposures can be taken even if the PC is not in the image receiving mode (i.e. the Image Capture button in DfW does not need to be pressed). This function will also work if the PC is not connected. Imaging programs and techique factors can be selected as in the user mode.
NOTE:
This function is is useful in situations, such as exhibtions, where there is no optical cable connection to the PC.

nCo No collimator check.

No collimator check when taking and exposure.

nCS Not in use.

nCh No checks at all.

Exposures can be taken without without the collimator position being checked. Also the 15 s wait period between exposures is not monitored.
Imaging programs and technique factors can be selected as in the user mode.

nrA Disables x-rays. No HW feedback.

non Disables all the above checks and x-rays. (nCh and nrA combined).

Using the GUI

1. Click the **Settings** tab.
2. From the **Ins** (*Sr 10 Ins*) list box select the required function.
   The functions are listed above in the "Using the control panel".

Sr 11 EPS - eps program

WARNING: X-rays are generated when this program is used.
When this program is selected the stepper motors do not operate and exposures can be taken with unit movements. This program is used during alignment, electrical troubleshooting and calibration.
NOTE
When this program is selected, the kVOK and mAOK signals are not monitored. Therefore C4 Inu and C5 FIL error codes are not enabled. Only the C3 gEn error code is monitored.

Using the control panel

1. Select ***Sr 11 EPS*** and press the **E** key. The current technique factors will appear on the display.
2. Press the **S+** or **S-** key to scroll throught the technique factors, kV, mA and exposure time.
3. Press the left or right upper **Partial panoramic** key to change the value of the selected technique factor.
4. Test exposures can now be taken, but there are no imaging movements during the exposure.
5. **IMPORTANT:**
   Exit programming without switching the power off.

Using the GUI

1. Select the **Settings** tab.

2. Click the **EPS** (*Sr 11 EPS*) radio button to activate it.

3. From the list box select the program type. The options are:
   - Still panoramic
   - Still Cephalo
   - No movement (panoramic)
   - No movement cephalo.
   Preselected technique factors for the selected option will appear in the **Imaging Parameters** group box.

4. If you wish to change the preselected technique factors enter new values in the appropriate fields in the **Imaging Parameters** group box (press the arrow up/down keys to change the time), and press the **Set** key.

5. Test exposures can now be taken, but there are no imaging movements during the exposure.

6. **IMPORTANT:**
   Exit programming without switching the power off.

Sr 12 PUP - Warmup program

WARNING: X-rays are generated when this program is used.
This program is used to:
- determine if the tube head assembly is defective.
- warm up a replacement of tube head.

It is also recommended that this program is used to warm up the tube head of any unit that has not been used for 3 months or more.

Using the control panel

1. Select ***Sr 12 PUP*** and press the **E** key. Technique factors ***5.0mA***, ***3.2s*** and **20kV** will appear on the display.

2. Protect yourself from radiation and and take an exposure. After the exposure the kV will automatically increase to the next level.

3. Immediately take another exposure at the new value.

4. Continue to take exposures each time the kV value increases. You do not have to wait between exposures.
   When the maximum kV value is reached the mA value will start to increase. Continue to take exposures until until the maximum technique factors are reached, ***85kV*** and ***10mA*** and the text ***End*** appear on the display.

   NOTE: If the tube arcs or malfunctions during an exposure the program will be terminated and an error message will appear.
   Clear the error message and restart the test by pressing the **E** key twice.
   If arcing and/or malfunctions occur repeatedly check the **kV and mA references at PUP**. This is described after **Using the GUI**.

5. After completing the test, exit the service program, set the unit for normal operation and take a panoramic exposure using the maximum technique factors to check that the unit is functioning correctly.

Using the GUI

1. Click the **Settings** tab.

2. Click the **PUP** (*Sr 12 PUP*) radio button to activate it.

3. Click the **Select** key.
   Technique factors ***20kv***, ***5.0mA*** and ***3.2s*** will appear in the **Imaging Parameters** field.

4. Now follow the same procedure, steps 2 to 5, as described in "Using the control panel".

Checking the kV/mA Feedback Reference Voltages

Checking the kV/mA Feedback Reference Voltages at PUP is done as follows:

To check the kV feedback reference voltage connect the **+**ve probe of a multimeter to **TP 19** on **N3301** and the **-**ve prove to **TP 17 GND**.

To check the mA feedback reference voltage connect the **+**ve probe of a multimeter to **TP 4** on **N3200** and the **-**ve probe to **TP 1 GND**.

Carry out the test described previously. The kV/mA Feedback Reference Voltages at PUP are listed below:
NOTE
The tolerance of the VkVref is ±0.18 and the tolerance of the VmAref is ± 10%.

KV	mA	s	(VkVref)	(VmAref)
20	5.0	3.2	(1.00 V)	(1.22 V)
30	5.0	3.2	(1.50 V)	(1.22 V)
40	5.0	3.2	(2.00 V)	(1.22 V)
50	5.0	3.2	(2.50 V)	(1.22 V)
54	5.0	3.2	(2.70 V)	(1.22 V)
57	5.0	3.2	(2.85 V)	(1.22 V)
60	5.0	3.2	(3.00 V)	(1.22 V)
63	5.0	3.2	(3.15 V)	(1.22 V)
66	5.0	3.2	(3.30 V)	(1.22 V)
70	5.0	3.2	(3.50 V)	(1.22 V)
73	5.0	3.2	(3.65 V)	(1.22 V)
77	5.0	3.2	(3.85 V)	(1.22 V)
81	5.0	3.2	(4.05 V)	(1.22 V)
85	5.0	3.2	(4.25 V)	(1.22 V)
85	6.0	3.2	(4.25 V)	
85	6.5	3.2	(4.25 V)	
85	7.2	3.2	(4.25 V)	
85	7.7	3.2	(4.25 V)	
85	8.0	3.2	(4.25 V)	(1.94 V)
85	8.5	3.2	(4.25 V)	
85	9.0	3.2	(4.25 V)	
85	9.5	3.2	(4.25 V)	
85	10.0	3.2	(4.25 V)	(2.43 V)

Sr 13 Prh - Preheat program

WARNING: X-rays are generated when this program is used.
This program automativally sets the preheat level of the tube head filament.
This must be done when the tube head or Filament board are changed.
The preheat level can also be set manually.

Using the control panel

1. Select ***Sr 13 Prh*** and press the **E** key. On the control panel displays numbers will appear:
   73 on the kV display,
   10 on the mA display,
   1 (not calibrated), or **xxx** (the last set preheat level), on the exposure values display.

2. Protect yourself from radiation and press and hold down the exposure button to take an exposure. During the exposure, the preheat level will start to rise. At the same time the unit will also check the mA value.
   When the desired mA value is reached the program will automatically stop the exposure.
   The new preheat level is usually between 80 and 120.

3. Press the **E** key to store the preheat level in the EEPROM.

4. Press hold the **E** key to exit the service mode and save the preheat level.

Using the GUI

1. Click the **Settings** tab.

2. Click the **Prh** (*Sr 13 Prh*) radio button to activate it.

3. Protect yourself from radiation and press and hold down the exposure button to take an exposure. During the exposure, the preheat level will start to rise. At the same time the unit will also check the mA value.
   When the desired mA value is reached the program will automatically stop the exposure.
   The new preheat level is normally between 80 and 120 and will apear in the active text box next to the **Prh** radio button.

4. Click the **Set** button to store the preheat level in the EEPROM.

5. Press hold the **E** key to exit the service mode and save the preheat level.

Manually selecting the Preheat level

1. Select the **Settings** tab.

2. Click the **Prh** (*Sr 13 Prh*) radio button to activate it.

3. In the empty text box next to the **Set** key, key in the preheat level you require.

4. Click the **Set** button to store the preheat level in the EEPROM.

Sr 14 FrE - Head/nasion support frequencies

This service program displays the frequency information that corresponds to the position of the panoramic head supports and the positions of the cephalometric head and nasion support.
This service program can only be accessed using the control panel.

Using the control panel only

1. Make sure that the fibre optic link is active.

2. Select ***Sr 14 FrE*** and press the **E** key. The frequency, in kHz, will appear on the display.

3. Press the **S+** or **S-** key to select the upper or lower display fields (ma / kV) and then left or right upper **Partial panoramic** key to change the option in the selected display field.
   In the upper display field you can select:
   - **PA**, panoramic head support frequency
   - **CE**, cephalometric head support frequency

   and in the lower:
   - **nA**, nasion support frequency
   - **hE**, head support frequency

   NOTE:
   If **nA** and **PA** are select no value will appear on the display as the position of the nasion support (nA) on the panormic head support (PA) is not monitored.

   When the nasion / head supports are manually moved the frequencies will change. The frequencies ranges are shown below:

Cephalometric nasion (CE + nA)	0.7 - 3.4 kHz (±0.1 kHz)
Cephalometric head support (CE + hE)	2.1 - 4.0 kHz (±0.1 kHz)
Panoramic head support (hE + PA)	2.1 - 4.0 kHz (±0.1 kHz)
(nA + PA)	- - -

To adjust the frequencies refer to:
N4200 for cephalometric head support
N5300 for panoramic head support
N5905 for cephalometric nasion.

Sr 15 SUP - line voltage check

Displays the the line voltage. The line voltage is monitored by measuring the incoming +25V supply on the Filament Control Board.
This service program can only be accessed using the control panel.

Using the control panel only

1. Select ***Sr 15 SUP*** and press the **E** key. The voltage will appear on the time display.

2. Press the **E** key to return to the service program mode.

Sr 16 CrL - Not in use

Sr 17 CEP - Not in use

Sr 18 FSt - Fast exposure time

Allows the exposure time to be selected.

Using the control panel

1. Select ***18 FSt*** and press the **E** key.
   The current setting, either **USr** (fast and slow exposure times, user selectable), **on** (fast exposure time only) or **OFF** (normal exposure time only), will appear on the exposure values display.

2. Press the appropriate upper **Partial panoramic** key to change the setting.

3. Press the **E**-key to accept the new setting and then press and hold down the **E**-key to to return to the user mode.

Sr 19 POS - Not in use

Sr 20 dnL - sw download program

This program allows the CPU to be switched so that it can download SW from the PC terminal program.
If this program is started accidentally turn the unit off, wait few seconds and then turn it on again. The unit should start normally.

Instructions on how to download software are in Section **5.1 Downloading software from a PC**.

I/O check program

This program allows the states of the CPU inputs and outputs to be checked without removing covers from the unit.
It is useful when trouble shooting CPU input signal problems, eg. the various micro switches and optocouplers.
The program shows whether or not signals from switches reach the CPU.
This service program can only be accessed using the GUI.

Using the GUI only

1. Select the **I/O ports** tab. The window shows the signals to and from the CPU.

   The signals are as follows:

SPI out 0

0	Proj Lit	Projector light enable (lights off)
1	Solena-	Child aperture solenoid enable
2	KV_frq_ena	Pan head width freq. enable (Auto kV)
3	n/a	Not used
4	n/a	Not used
5	n/a	Not used
6	n/a	Not used
7	n/a	Not used
8	n/a	Not used
9	n/a	Not used
10	n/a	Not used
11	n/a	Not used
12	Z Dir	Z-carriage (0=up, 1=down)

13	Z Ena	Z-carriage movement enable (1)
14	n/a	Not used
15	n/a	Not used

SPI out 1

0	Cas Dir	Collimator direction
1	Cas Ena	Collimator movement enable
2	Rot Dir	Rotation movement direction
3	Rot Ena	Rotation movement enable
4	Ceph Dir	Cepd CCD direction
5	Ceph Ena	Cepd CCD enable
6	Lin Dir	Linear movement direction
7	Lin Ena	Linear movement enable
8	P Power	Pan CCD power on
9	P Image	Pan CCD image capture on
10	C Power	Ceph CCD on
11	C Image	Ceph CCD capture on
12	n/a	Not used
13	n/a	Not used
14	Clas Lit	Ceph head width freq. enable (Auto kV)
15	n/a	Not used

Port 5

0	Exp Sw	Exposure switch (pressed)
1	Instru Sw	Not used
2	Ma OK	Tube current OK
3	n/a	Not used
4	Exh Sw	Option (exhibition) switch on
5	In 3	Mirror (1=closed)
6	Mains	N4700 S1 or S2 (S1=1, S2=0)
7	In 2	Child solenoid on
8	Tube Fail	Tube head high voltage breakdown. (no breakdown)
9	Pan Cas Sw	Not used
10	Cas Lim Sw	Not used
11	Cas Mid Sw	Collimator
12	Lin Mid Sw	Linear (Y) movement position

13	Lin Lim Sw	Linear (Y) movement position
14	Sec. Slit Mid Sw	Secondary slit position
15	Sec. Slit Lin Sw	Secondary slit position

Port 6

0	Flash	Flash
1	Sram	SRAM
2	n/a	Not Used
3	n/a	Not Used
4	WD	Watchdog
5	E2Prom CS	EEProm chip select
6	SPI select	SPI chip select
7	n/a	Not used
8	SPI CS 1	SPI chip select
9	n/a	Not connected
10	n/a	Not connected
11	n/a	Not connected
12	n/a	Not connected
13	n/a	Not connected
14	n/a	Not connected
15	n/a	Not connected

SPI in 0

0	n/a	Not Used
1	n/a	Not Used
2	Pil Ward	Y-movement to left (towards the column)
3	Zena	Zena (from z-buttons)
4	Yforw	Y-movement to right
5	Temp Fail	Tube head temperature switch
6	Service Sw	Service switch
7	n/a	Not Used
8	S sens1	Collimator position (same as SSens 1) Pan 1 Ceph 0
9	S sens2	Collimator pos. (SSens 2 or gnd) Pan 0 Ceph 1
10	S sens2	Collimator pos (SSens 2) Pan 0 Ceph 1
11	n/a	Not used
12	Return	Return button
13	n/a	Not used
14	Z Down P	Z-carriage DOWN, pan button
15	Z Up P	Z-carriage UP, pan button

SPI in 1

0	Ceph Lok	Ceph ccd position		
1	Ceph Cok	Ceph ccd position		
2	Ceph Rok	Ceph ccd position		
3	Ceph Lat Pa	Ceph patient head position		
4	Ceph L	No ceph or ceph on the left (ceph on the left)		
5	Ceph R	No ceph or ceph on the right (ceph on the right)		
6	Z Down C	Z-carriage down, ceph button		
7	Z Up C	Z-carriage up, ceph button		
8	Rot 1 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 1	1	1	1
9	Rot 2 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 2	1	0	0
10	Rot 3 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 3	0	0	0
11	Rot 4 Sw	Rotation movement position		
		PIO	Stop	PanStart
	Rot 4	1	0	1
12	Z Mid Sw	Z-carriage in upper limit		
13	Z Lim Sw	Z-carriage in either limit		
14	Ceph Mid Sw	Ceph movement detector (start or end) n)		
15	Ceph Lim Sw	Ceph movement detector (in the middle)		

CP Buttons

0	Btn S +	Control panel S + button
1	Btn Section 1	Control panel partial exp. 1 button
2	Btn Ltd. Ceph	Control panel reduced ceph button
3	Btn S -	Control panel S - button
4	Btn E	Control panel E button
5	Btn T	Control panel Test button
6	Btn 57 kV	Control panel 57 kV button
7	Btn Section 5	Control panel partial exp. 5 button
8	Btn Adult Pan	Control panel adult pan button
9	Btn Child Pan	Control panel child pan button
10	Btn TMJ	Control panel TMJ button
11	Btn Ceph	Control panel ceph button
12	Btn Section 4	Control panel partial exp. 4 button
13	Btn Section 3	Control panel partial exp. 3 button
14	Btn Section 2	Control panel partial exp. 2 button
15	n/a	Not used

CP Buttons

0	Btn 85 kV	Control panel 85 kV button
1	Btn 81 kV	Control panel 81 kV button
2	Btn 77 kV	Control panel 77 kV button
3	Btn 73 kV	Control panel 73 kV button
4	Btn 70 kV	Control panel 70 kV button
5	Btn 66 kV	Control panel 66 kV button
6	Btn 63 kV	Control panel 63 kV button
7	Btn 60 kV	Control panel 60 kV button
8	-MIRROR	Mirror position
9	SLOK	Solenoid for child pan collimator
10	n/a	Not used
11	n/a	Not used
12	n/a	Not used
13	n/a	Not used
14	n/a	Not used
15	n/a	Not used

5. Cranex D software

5.1 Downloading software - s/n B81642 and earlier

Using the C167 SW Loader - s/n B81642 and earlier

The RS232 serial interface cable (part number 4801742) that links the unit to the PC is used to download the Cranex D software.
The serial interface protocol is:
8 databits, 1 stop bit, no parity, 4800 Bd.

1. Switch the unit off and remove the Z-carriage front cover. (6-screws).

2. Connect Test Connector (SERVICESW 4801744) to connector X90 and the jumper to connector X14 on the digital I/O board (N5200).

3. Press and hold down the **E**-key until you hear four beeps and service program code appears on the control panel displays.
   The service program type, ***Ur*** for User or ***Sr*** for Service, will appear on the kV-display.
   The service program number will appear on the mA-display and an abbreviation (three characters) of the service program name will appear on the exposure time-display .

   The unit is now in the Service Program mode.

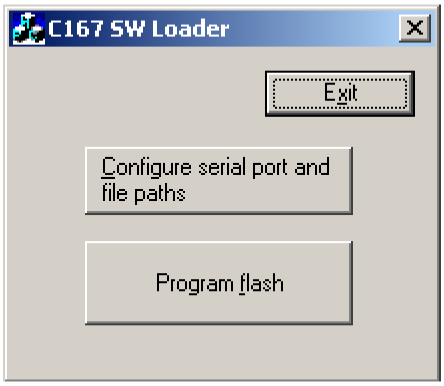
4. Press the **Up**/**Down** hidden keys and scroll through the service programs until you reach service program ***Sr 20 dnl***.

5. Briefly press the **E**-key to enter the parameter selection mode for that program.

6. Press the **Left/Right** hidden keys to select ***dnl***, download (no = no download) and then press **E** to activate download, ***dnl*** will stop blinking.

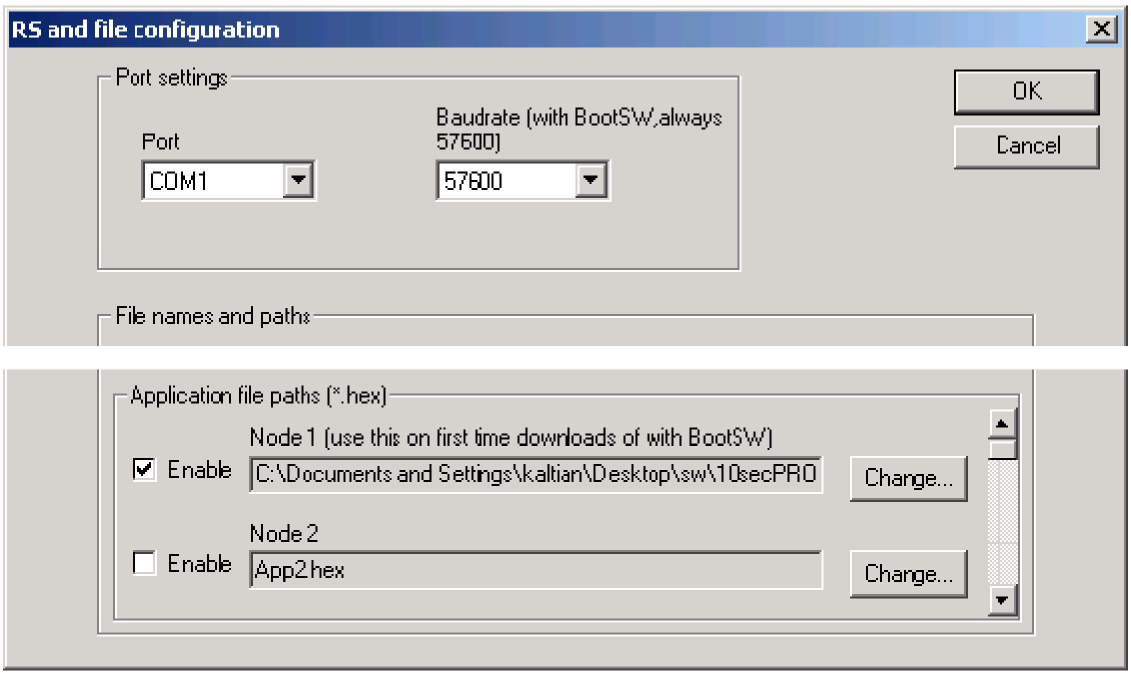
7. Switch on the PC and close the GUI if it is open. Insert the Cranex D service CD into the PC and copy c167swdl_pack folder and the binary file .hex (software update) onto the PC hard drive.

8. Start the program C167Ldr.



Click the **Configure serial ... file paths** button.

9. The **RS and file configuration** window will appear.



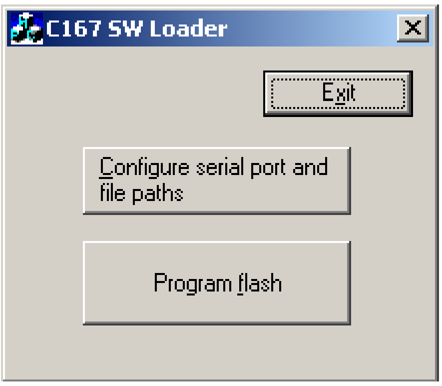
In the **Port settings** section select **Port** COM1 and **Baudrate** 57600.

In the **Application file paths...** section click the **Enable** box next to the **Node 1** field to activate it.

Click **Change** and select the software to be updated (.hex-file). Disable the other options.

Click **OK** to exit.

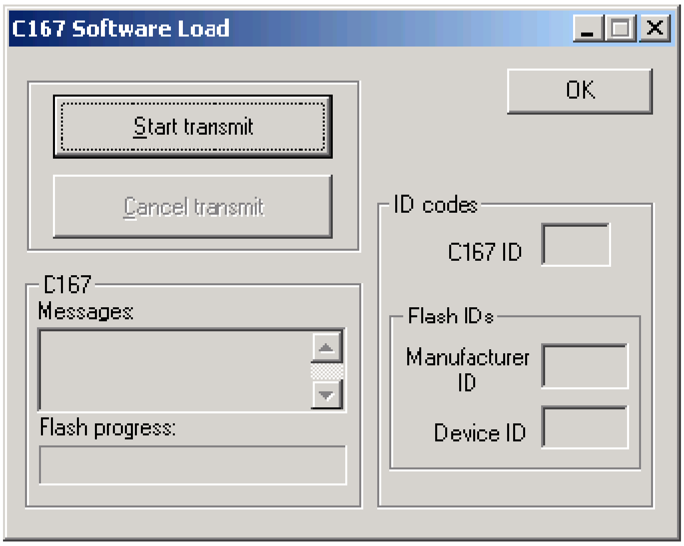
10. The **C167LSW Loader** window will reappear.



Click the **Program flash** button.

NOTE:
You must change the port setting if you did not select COM 1 and COM 2 ports. For example if you used COM 5 and COM 6 ports, select COM 5.

11. The **C167LSW Software Load** window will appear.



Click **Start transmit** to start download. After a while **stand alone node present** text will appear in the **Messages** box. The **Flash progress** bar will start to move. After a few minutes the Cranex D will automatically start and the checksum will appear in the **Messages** field.

12. Close the C167 loader application.

Using the PaloDEx SWDL Tool - s/n B81642 and earlier

NOTE:
The fibre optic cable that links the unit to the PC is used to download the Cranex D software.

1. Close DfW and the Cranex D GUI.

2. Stop the OPCC service from the Windows Services (Control panel \ Administrative Tools \ Services \ OPCC).

3. Switch the unit off and remove the Z-carriage front cover. (6-screws).

4. Connect Test Connector (SERVICESW 4801744) to connector X90 and the jumper to connector X14 on the digital I/O board (N5200).

5. Switch the unit on.

6. Press and hold down the **E**-key until you hear four beeps and service program code appears on the control panel displays.
   The service program type, ***Ur*** for User or ***Sr*** for Service, will appear on the kV-display.
   The service program number will appear on the mA-display and an abbreviation (three characters) of the service program name will appear on the exposure time-display .

   The unit is now in the Service Program mode.

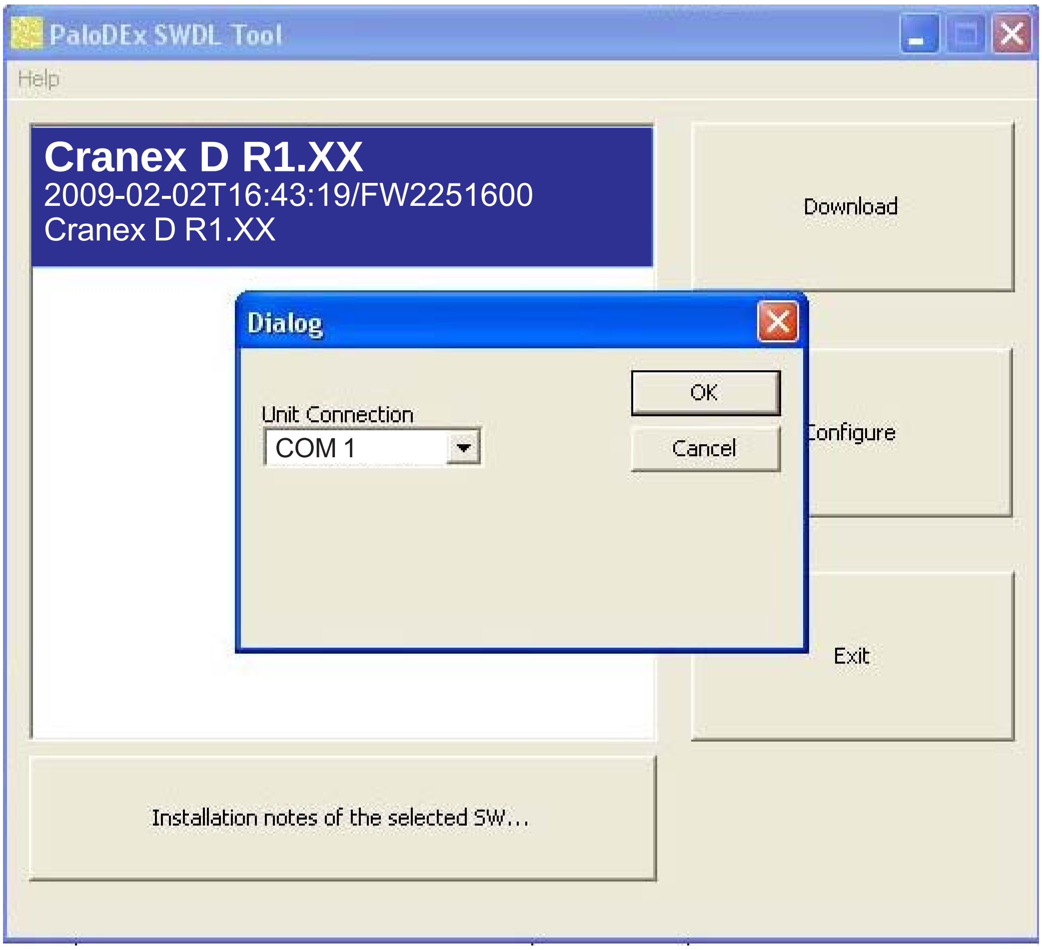
7. Press the **Up/Down** hidden keys and scroll through the service programs until you reach service program ***Sr 20 dnl***.

8. Briefly press the **E**-key to enter the parameter selection mode for that program.

9. Press the **Left/Right** hidden keys to select ***dnl***, download (no = no download) and then press **E** to activate download, ***dnl*** will stop blinking.

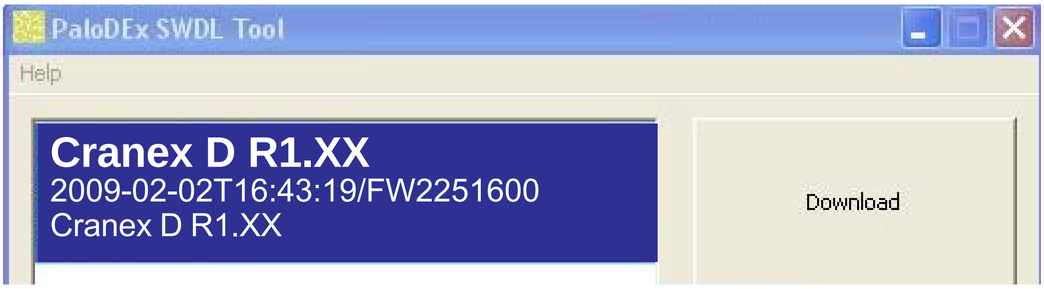
10. Launch the Software Download Tool. the PaloDEx SWDL Tool window will appear.

11. In the **PaloDEx SWDL Tool** window click the **Configure** button. The **Dialog** window will appear.



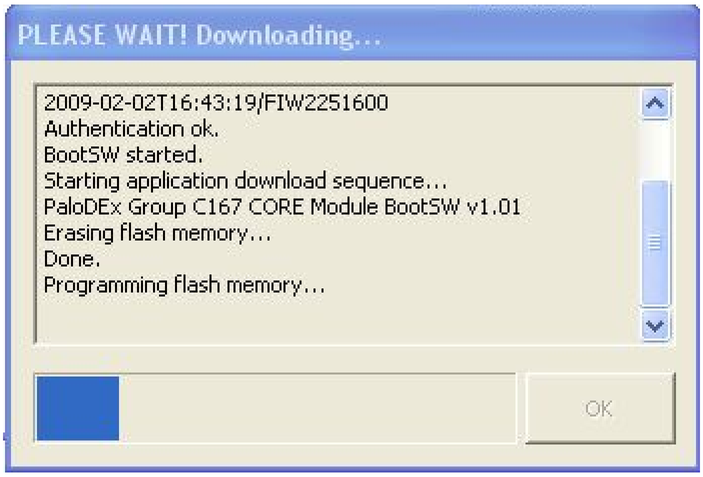
From the **Unit Connection** dialog box select **Fibre optic link** and then press **OK**.

12. From the **PaloDEx SWDL Tool** select the software package to be downloaded into the unit.



Click the **Download** button to start SW download.

13. The Software Download Tool **Downloading ...** window will appear during the software downloading process.



WARNING!
Do not operate with the unit or PC while downloading the software. Do not interrupt the software update process once it is launched. Interrupting the downlaoding process may cause the unit Core Module to become unstable.

14. When the download process is successfully completed the results window will appear.

Click **OK** to displayed some additional information about the new software version.

15. Restart the OPCC or restart the PC.

16. Restart the unit and make sure that it is working properly.

17. It is recommended to take test images (pin and ball phantom) to assure the alignment and functionality of the unit.

5.2 Downloading software - s/n B91643 and later

Using the PaloDEx SWDL Tool - s/n B91643 and later

NOTE:
The fibre optic cable that links the unit to the PC is used to download the Cranex D software.

1. Close DfW and the Cranex D GUI.

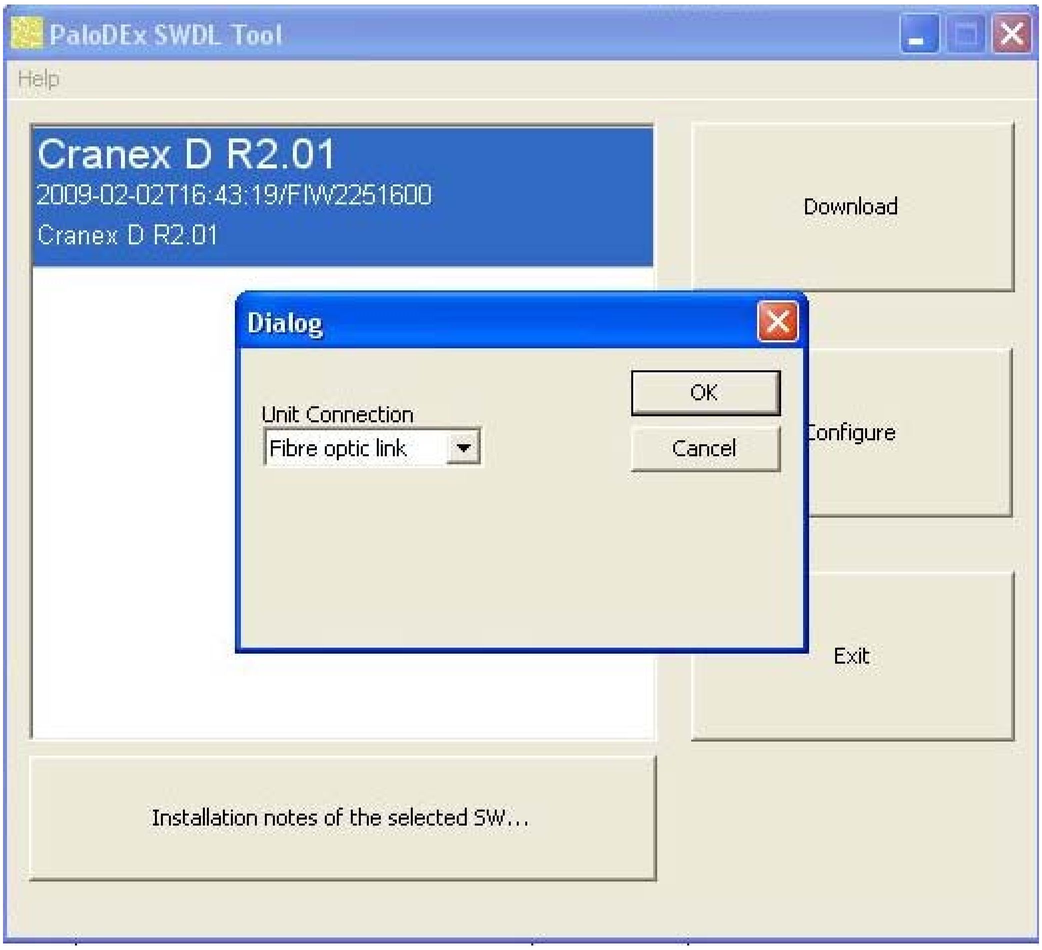
2. Stop the OPCC service from the Windows Services (Control panel \ Administrative Tools \ Services \ OPCC).

3. Enter the **service mode**.
   First press and hold down the **E** key (3 seconds) until you hear a beep, the unit is now in the **unit settings mode** (unit settings have the prefix **Ur**).

   Then press and hold down the top **Left** partial panoramic key and then press and hold down the top **Right** partial panoramic key. Release the **Left** key and then release the **Right** key.
   You will hear a beep and the unit will enter the **service programs mode** (service programs have the prefix **Sr**). No particular service program needs to be selected.

4. Launch the Software Download Tool. The PaloDEx SWDL Tool window will appear.

5. In the **PaloDEx SWDL Tool** window click the **Configure** button. The **Dialog** window will appear.

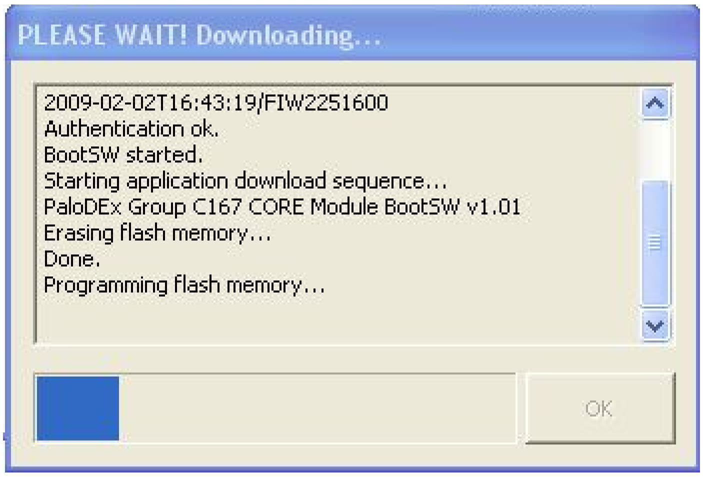


From the **Unit Connection** dialog box select **Fibre optic link** and then press **OK**.

6. From the **PaloDEx SWDL Tool** select the software package to be downloaded into the unit.

Click the **Download** button to start SW download.

7. The Software Download Tool **Downloading ...** window will appear during the software downloading process.



WARNING!
Do not operate with the unit or PC while downloading the software. Do not interrupt the software update process once it is launched. Interrupting the downlaoding process may cause the unit Core Module to become unstable.

8. When the download process is successfully completed the results window will appear.

Click **OK** to displayed some additional information about the new software version.

9. Restart the OPCC or restart the PC.

10. Restart the unit and make sure that it is working properly.

11. It is recommended to take test images (pin&ball phantom) to assure the alignment and functionality of the unit.

5.3 PCI board driver

PCI board driver software is installed during the unit installation. If it has to be reinstalled, use the Cranex D Installation CD to reinstall it.
The PCI driver is a software component that enables the PCI card electronics to be accessed by with Windows operating system.

5.4 Graphical User Interface (GUI)

The GUI is the Cranex D user interface panel on the PC screen. This software in PC is provided to communicate with the Cranex D to set and display kV, imaging mode and exposure time.

GUI consist also a special PP1 Service Assistant software which can be used to service and debug the unit.

See section **4. Service Programs** for more information.

GUI is installed during Cranex D installation.

6. Circuit Boards

N3000 PCI Board

N3000 Location

Inside the PC.

N3000 Field replaceable parts

None.

N3000 Description

The board is a bridge between the optical / serial (from main CPU) and the electrical / parallel PCI bus. It sorts incoming image and control data according to the address attached to the data.
The board includes an FPGA based logic “series to parallel converter”, a 16MHz oscillator and internal 10-multiplier for the Link clock (160MHz).
The length of the optical fibre cable that connects the PC to the unit is 10m and the data transmission speed is 160 Mbps.

N3000 Indicator LEDs

LED	Colour	Description
H1	Green	LINK_OK
H2	Red	EPROM failure
H3	Green	+3.3V
H4	Green	+5V
H5	Red	Local reset

N3100 Rotation Connector Board

N3100 Location

Inside the sensor holder side of the rotating unit.
To access, remove the CCD sensor, the sensor holder cover and then the inner cover from the receptor side of the rotating unit.

N3100 Field replaceable parts

None.

N3100 Description

There are numerous connectors on this board. The purpose of this board is to transfer the signals passing through the main cable (the large cable bundle) to the electronics in the rotating unit. The other end of the main cable is goes to the Top Rack Connector Board.
The Rotation Connector Board also includes solenoid control electronics which are needed for the child panorama program. The solenoid control electronics are activated on the descending edge of “solena-” –signal.
The circuit board also generates various supply voltages: VCC_+5V, VAP_+18V, VSP_+5V and +5.7V. All these are derived from a +34V-voltage supply using swiching regulators.

N3100 Indicator LEDs

LED	Colour	Description
H1	green	+5V
H2	green	VCC_+5V
H3	green	VSP_+5V
H4	green	VAP_+18V
H5	green	+5.7V
H6	green	+34V
H7	green	-25V
H8	green	+25V

N3100 Test points

Pin	Signal	Description
TP1	GND	-
TP2	VCC_+5V	
TP3	VAP_+18V	Analog +18VDC (used on Data Interface Board)
TP4	VSP_+5V	
TP5	+5.7V	Voltage (+5.7VDC) (used on Terminal Board).
TP6	GND	-
TP7	+34V	Incoming supply voltage (+34V)
TP8	GND	-

N3100 Connectors

Connector J3102

Pin	Signal	Description
1	PDETCLK	CCD detector clock
2	Not used	
3	PPOWER-	Pan-ccd power enable
4	PIMAGE-	Pan-ccd image enable
5	NC	Not used
6	RDX2	Receive data signal
7	TXD2	Transmit data signal
8	Not used	
9	Not used	
10	AEC_FRQ_TO_CPU	Frequency line to CPU

Connector J3103

Not Used

Connector J3104

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	SOL_VOLTAGE	Solenoid voltage
4	GND	Ground
5	SOLOK-	Solenoid ok
6	SSENS1	Slit position sensor 1
7	SSENS2	Slit position sensor 2
8	GND	Ground

Connector J3105

Pin	Signal	Description
1	+34V	Power supply voltage
2		Patient position light enable

Connector J3106

Pin	Signal	Description
1-2	Not used	
3	VSP_+5V	Power supply voltage (CCD)
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	VAP_+18V	Power supply voltage (CCD)
11	VCC_+5V	Power supply voltage (CCD)
12	-	Not used
13	+5.7V	Power supply voltage (CCD)
14	+5.7V	Power supply voltage (CCD)

Connector J3107

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	SOLOK-	Solenoid ok
4	-	Not used
5	PROJLIT	Patient position light enable
6	IN1	Not used
7	AEC_FRQ_TO_CPU	AEC-frequency
8	GND	Ground
9	TXD2	Transmit data signal
10	RDX2	Receive data signal
11	GND	Ground
12	PDETCLK	CCD detector clock
13	GND	Ground
14	PPOWER-	Pan-ccd power active
15	PIMAGE-	Pan-ccd image active
16	GND	Ground

Connector J3108

Pin	Signal	Description
1	-	Not used
2	-	Not used
3	-	Not used
4	-	Not used
5	-	Not used
6	COL1SW	Slit position sensor1
7	-	Not used
8	COL3SW	Slit position sensor2
9	SOLENA-	Solenoid enable
10	-	Not used
11	-	Not used
12	-	Not used
13	-	Not used
14	-	Not used
15	-	Not used
16	-	Not used

Connector J3109

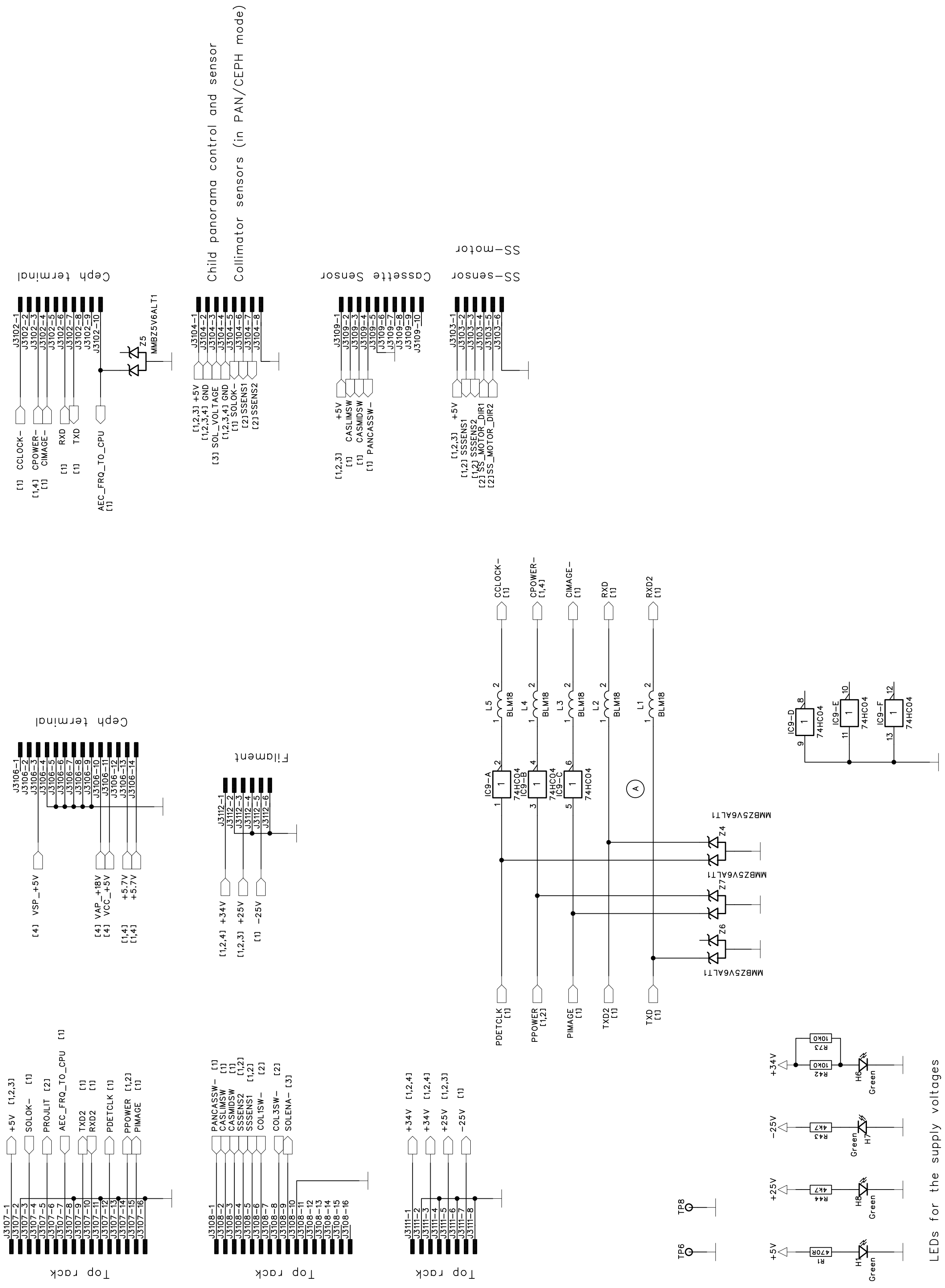
Not used

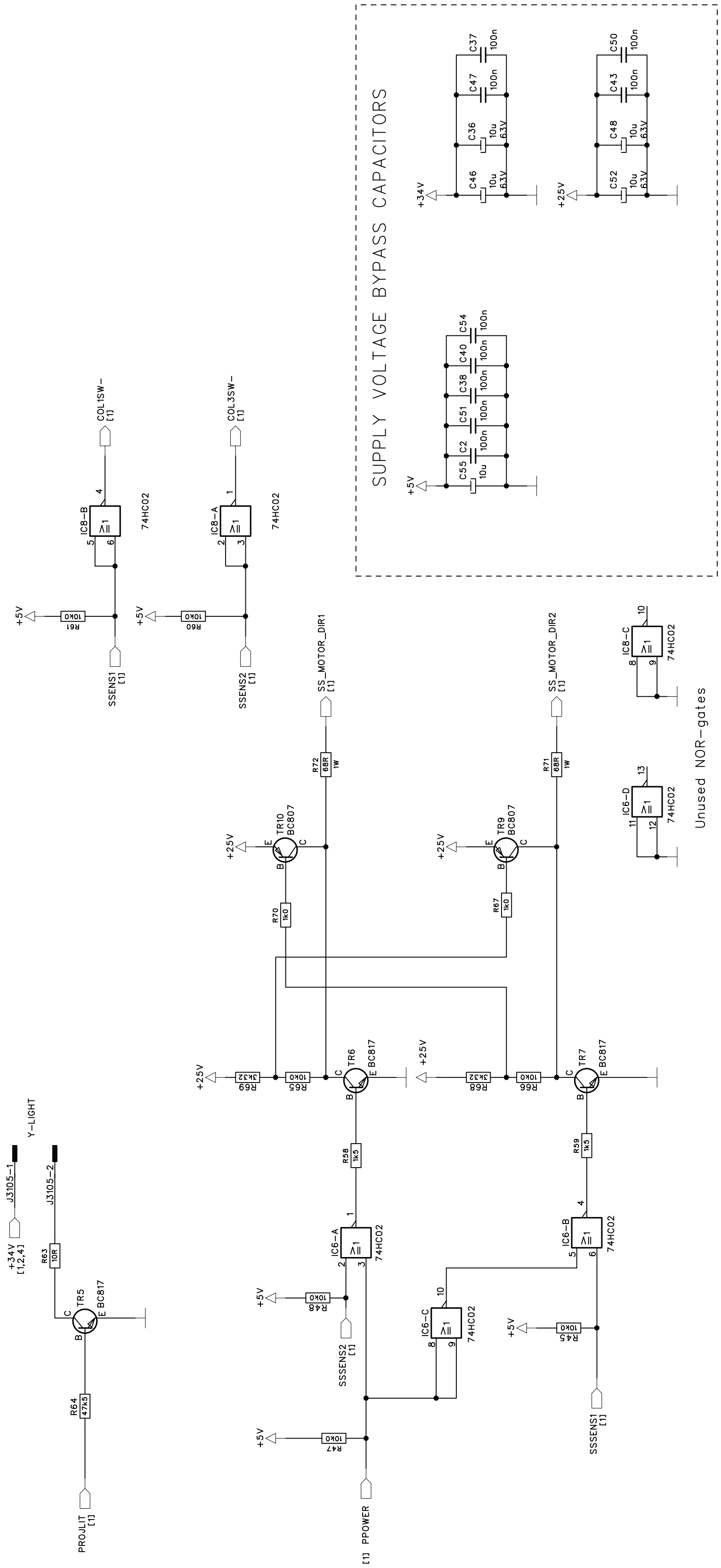
Connector J3111

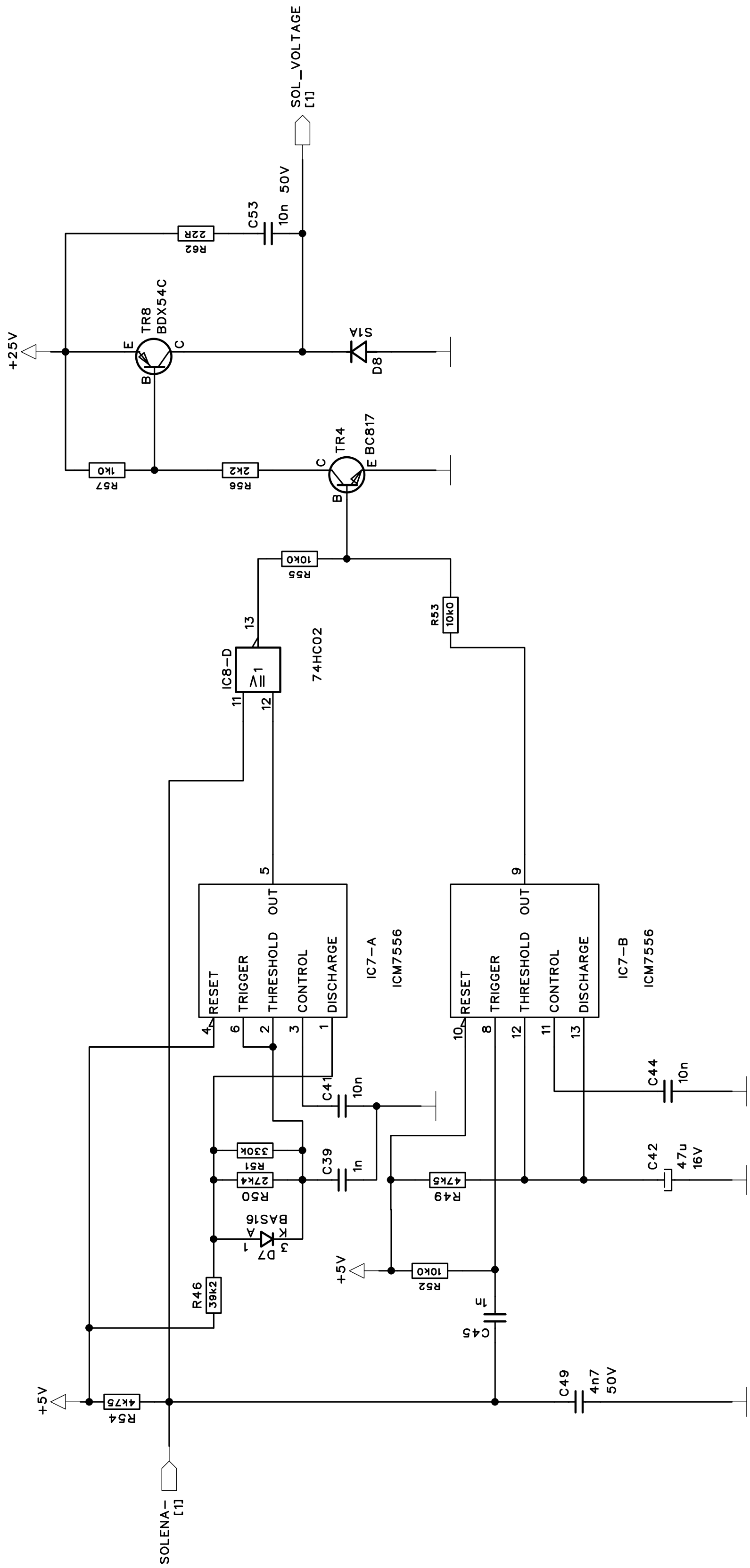
Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	+34V	Power supply voltage
4	GND	Ground
5	+25V	Power supply voltage
6	GND	Ground
7	-25V	Power supply voltage
8	GND	Ground

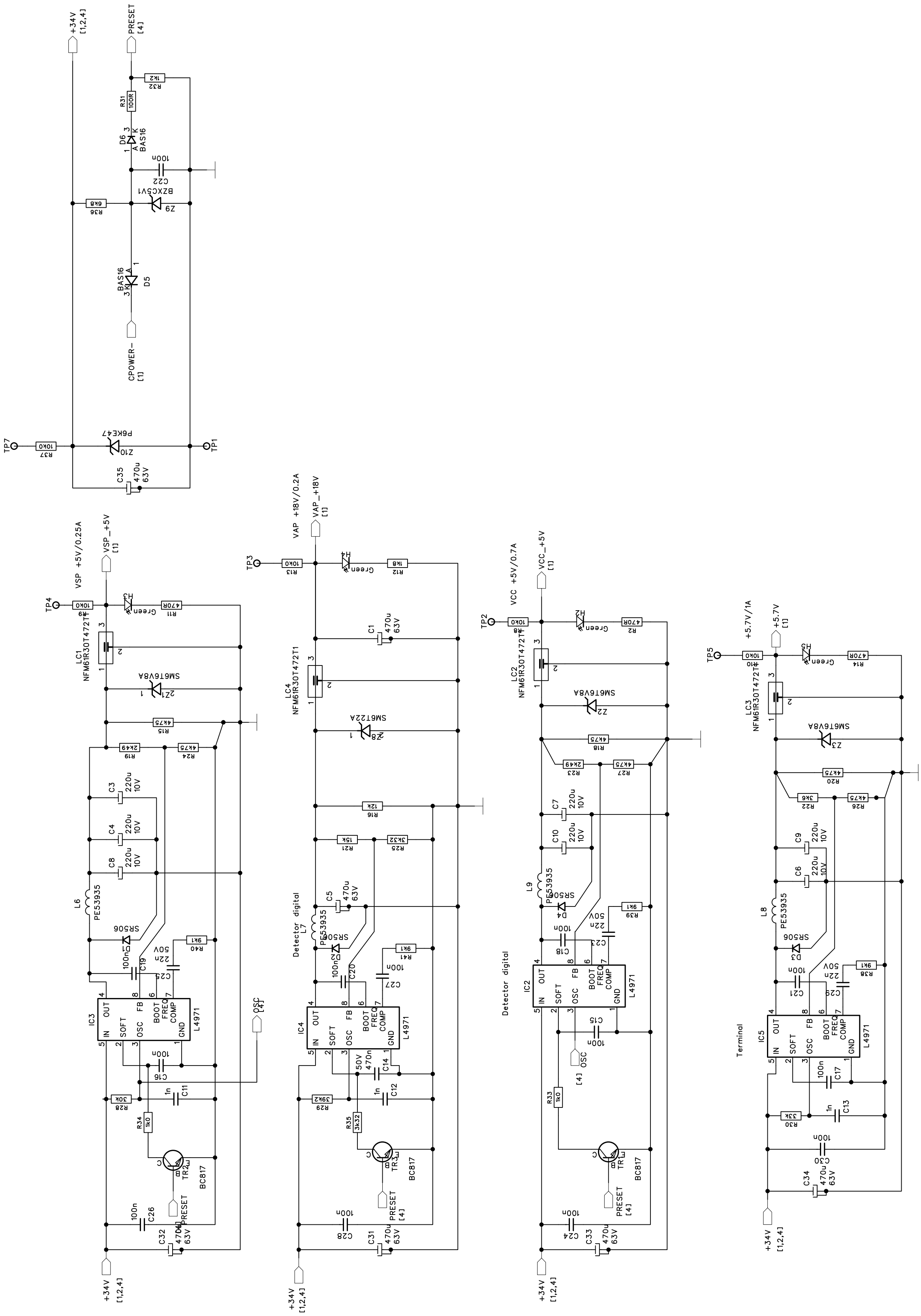
Connector J3112

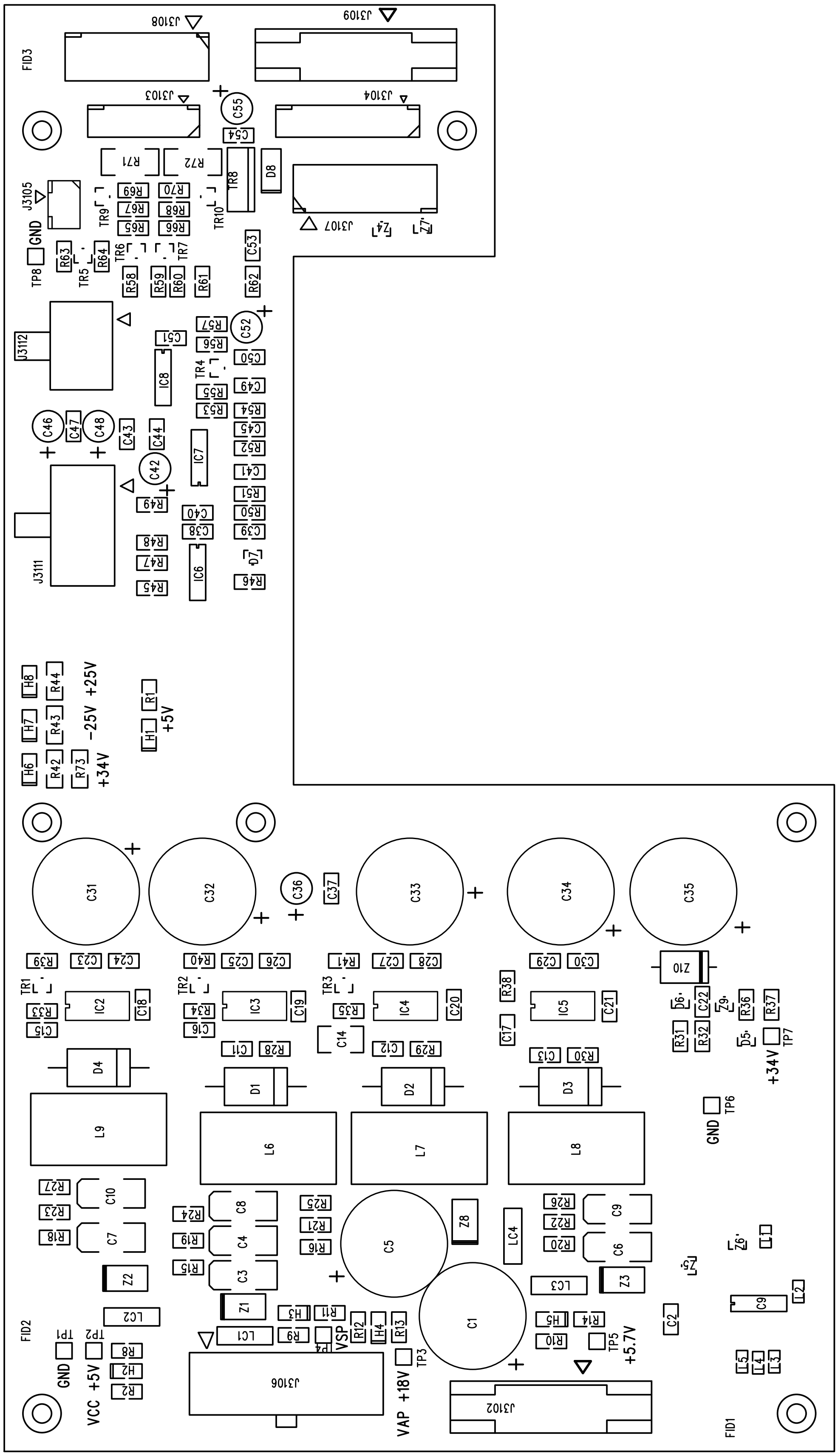
Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	-25V	Power supply voltage
6	GND	Ground


Ceph terminal
Child panorama control and sensor
Collimator sensors (in PAN/CEPH mode)
Cassette Sensor
SS-sensor
SS-motor
Ceph terminal
Filament
Top rack
Top rack
Top rack
LEDs for the supply voltages


SUPPLY VOLTAGE BYPASS CAPACITORS
Unused NOR-gates


SOL_VOLTAGE
[1]
C53
10n 50V
R62
22R
TR8
BDX54C
+25V
D8
S1A
TR4
BC817
R57
1k0
R56
2k2
R55
10k0
R53
10k0
IC8-D
74HC02
IC7-A
ICM7556
IC7-B
ICM7556
RESET
TRIGGER
THRESHOLD
CONTROL
DISCHARGE
OUT
C41
10n
C39
1n
R51
330k
R50
27k4
D7
BAS16
R46
39k2
+5V
R52
10k0
C45
1n
R49
47k5
C44
10n
C42
47u
16V
C49
4n7
50V
R54
4k75
SOLENA-
[1]


+34V [1,2,4]
PRESET [4]
CPOWER- [1]
TP7
TP1
VSP +5V/0.25A
VSP_+5V [1]
VAP +18V/0.2A
VAP_+18V [1]
VCC +5V/0.7A
VCC_+5V [1]
+5.7V/1A
+5.7V [1]
TP2
TP3
TP4
TP5
L4971
BC817
Detector digital
Terminal


J3108
J3109
J3103
J3104
J3105
J3107
J3112
J3111
J3106
J3102
GND
TP8
+25V
-25V
+34V
+5V
+34V
TP7
GND
TP6
GND
TP1
TP2
+5V
VCC
VSP
VAP
+18V
TP3
TP5
+5.7V

N3200 Filament Control Board

N3200 Location

Inside the rotating unit, tubehead side.
To access, remove the tubehead cover, head support assembly and rotating unit inner cover.

N3200 Field replaceable parts

None.

N3200 Description

The Filament Control Board produces a filament voltage for tube head using a current reference from the CPU and current feedback from the Tube Head Board. It also produces frequency information on current feedback, current reference, line voltage feedback and 5V during the different operating stages.

The board produces its power supply voltages, ±15V, from the ±25V supply. LEDs H1, H2, H3 and H4 should be on when power is on. During stand by the board measures the line voltage, 24V, and the frequency information goes to the digital I/O board. When an exposure begins, the filament is preheated for a short period and then the current can be controlled. Frequency information is also sent to the CPU.

N3200 Indicator LEDs

LED	Colour	Description
H1	green	+25V power supply
H2	green	+15V power supply
H3	green	+34V power supply
H4	green	-15V power supply
H5	red	mAok, on when mAfb is higher than mAref
H6	red	prehrel, on when preheat relay is on
H7	red	preh, on when preheat is on
H8,H9	red	Pulse2, on when filament transformer is driven
H10-11	red	Pulse1, on when filament transformer is driven
H12	red	Tube temperature, on when overheated

N3200 Test points

TP	Signal	Description
TP1	GND	Ground
TP2	MAFB	Current feedback
TP4	MAREF	Current reference
TP5	PREH	Preheat
TP6	PREHREL	Preheat relay
TP7	EXPENA	Exposure enable
TP8	-15V	Power supply voltage
TP9	+15V	Power supply voltage
TP10	+25V	Power supply voltage
TP11	+34V	Power supply voltage
TP13	GND	Ground

N3200 Connectors

Connector X35

Pin	Signal	Description
1	+34V	Power supply voltage
2	gnd	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	-25V	Power supply voltage
6	GND	Ground

Connector X36

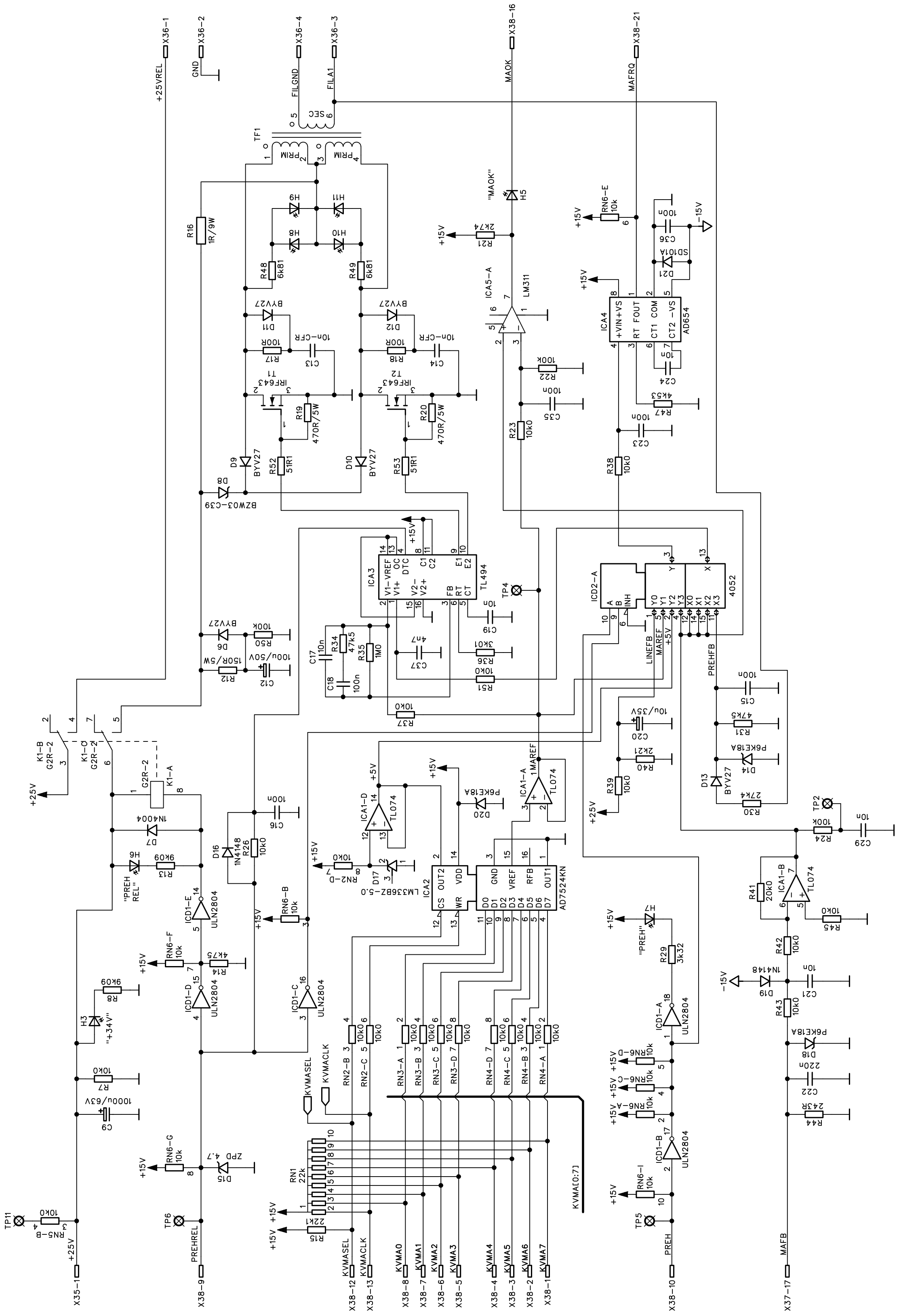
Pin	Signal	Description
1	+25Vrel	Preheat relay controlled power supply voltage
2	GND	Ground

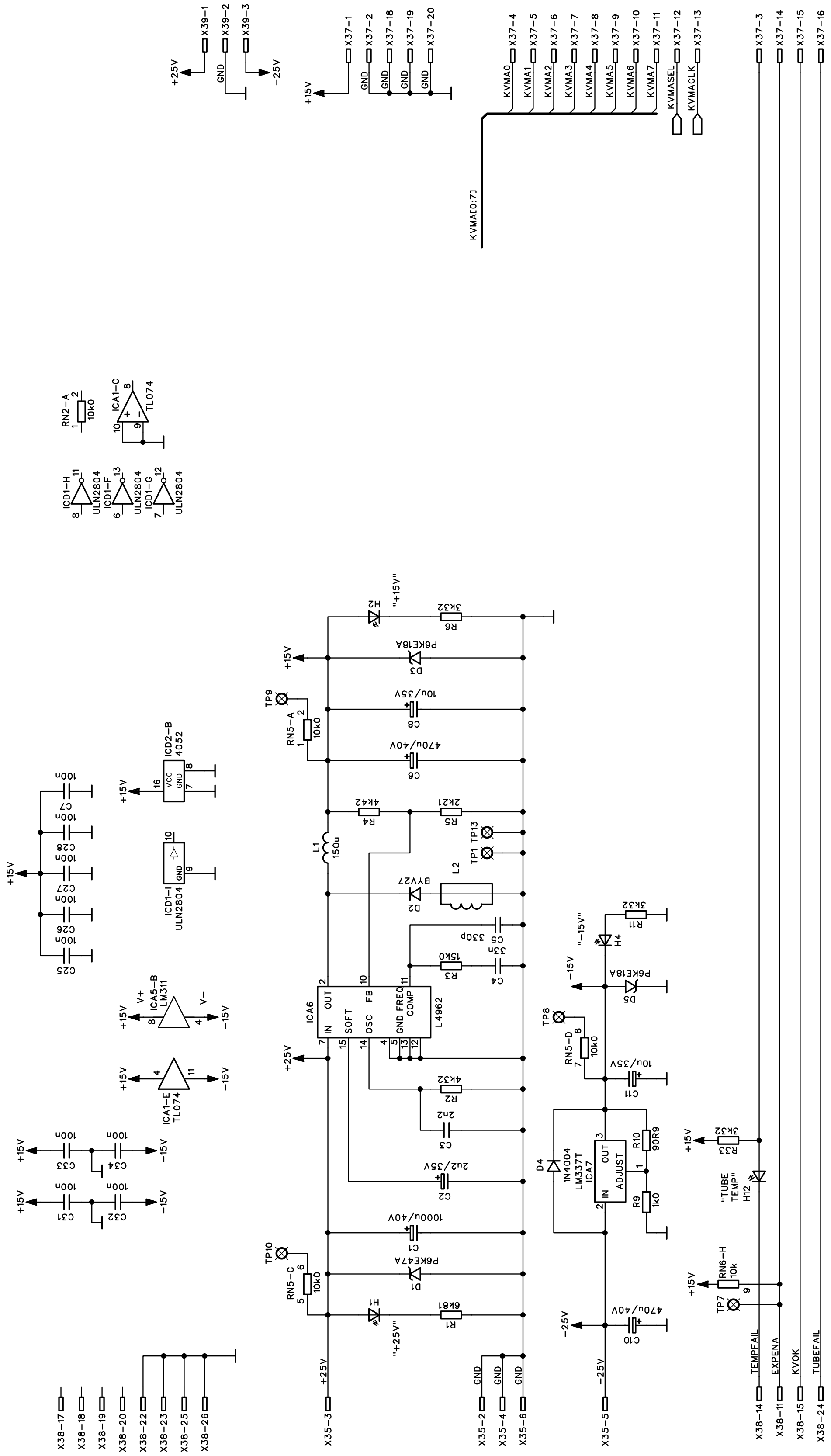
Connector X37

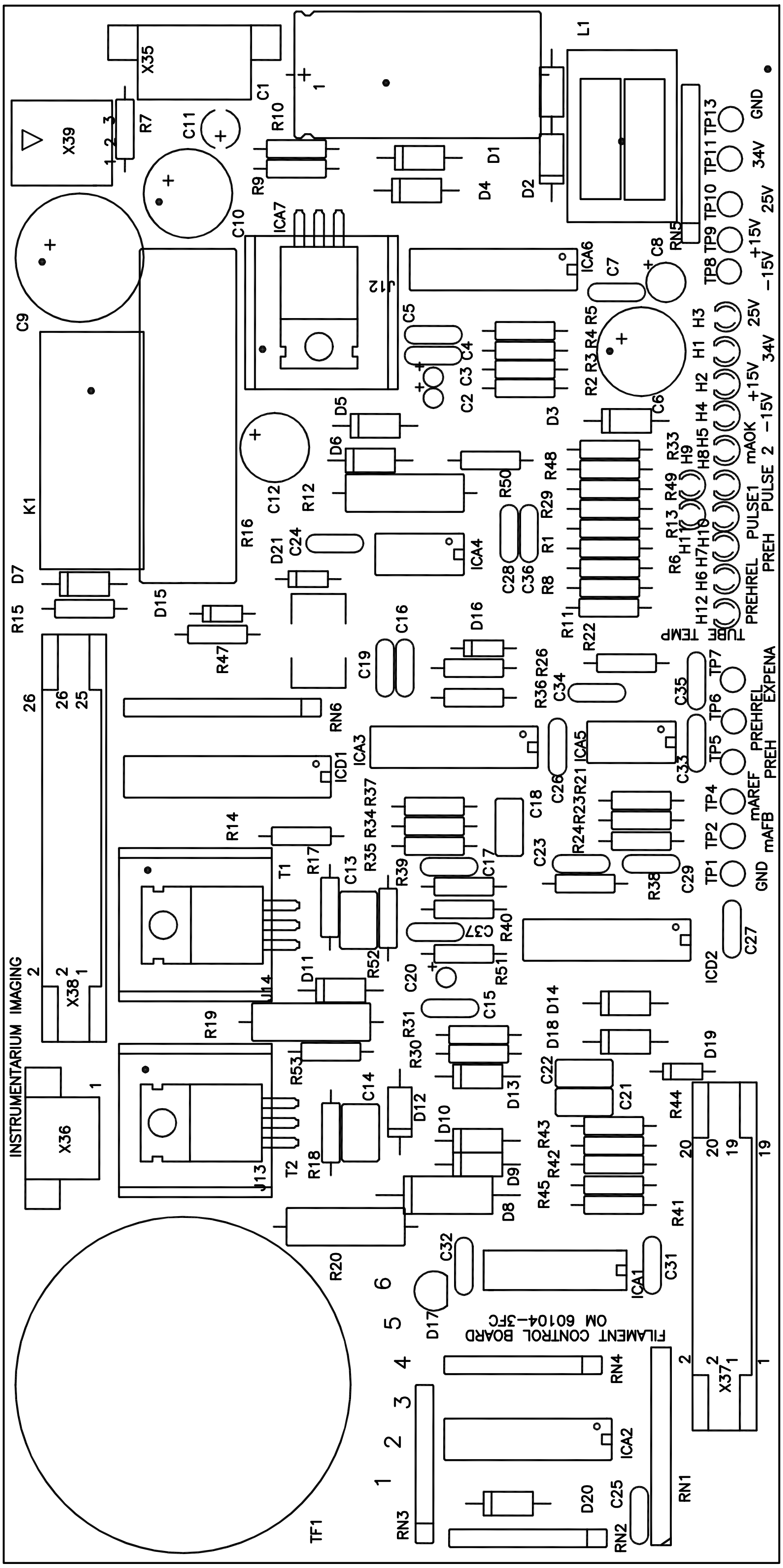
Pin	Signal	Description
1	+15V	Power supply voltage
2	GND	Ground
3	Tempfail	Temperature too high
4	kVmA0	Digital kV and mA references
5	kVmA1	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA3	Digital kV and mA references
8	kVmA4	Digital kV and mA references
9	kVmA5	Digital kV and mA references
10	kVmA6	Digital kV and mA references
11	kVmA7	Digital kV and mA references
12	kVmAsel	Select kV or mA

Connector X38

Pin	Signal	Description
1	kVmA7	Digital kV and mA references
2	kVmA6	Digital kV and mA references
3	kVmA5	Digital kV and mA references
4	kVmA4	Digital kV and mA references
5	kVmA3	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA1	Digital kV and mA references
8	kVmA0	Digital kV and mA references
9	Prehrel	Preheat relay control
10	Preh	Preheat control
11	Expena	Exposure enable
12	kVmAsel	Select kV or mA
13	kVmAclk	Clock
14	Tempfail	Temperature too high
15	kVok	KV control is ok
16	mAok	MA control is ok
17	-	Not used
18	-	Not used
19	-	Not used
20	-	Not used
21	mAfrq	current to frequency information
22	GND	Ground
23	GND	Ground
24	Tubefail	Failure in tube head
25	GND	Ground
26	GND	Ground




X39-1
X39-2
X39-3
+25V
GND
-25V
X37-1
X37-2
X37-18
X37-19
X37-20
+15V
X37-4
X37-5
X37-6
X37-7
X37-8
X37-9
X37-10
X37-11
X37-12
X37-13
KVMA0
KVMA1
KVMA2
KVMA3
KVMA4
KVMA5
KVMA6
KVMA7
KVMASEL
KVMACLK
KVMA[0:7]
X37-3
X37-14
X37-15
X37-16
RN2-A 10k0
ICA1-C TL074
ICD1-H ULN2804
ICD1-F ULN2804
ICD1-G ULN2804
ICD2-B 4052
ICD1-I ULN2804
ICA5-B LM311
ICA1-E TL074
ICA6 L4962
ICA7 LM337T
D4 1N4004
D1 P6KE47A
D2 BYV27
D3 P6KE18A
D5 P6KE18A
H1 "+25V"
H2 "+15V"
H4 "-15V"
H12 "TUBE TEMP"
L1 150u
L2
C1 1000u/40V
C2 2u2/35V
C3 2n2
C4 33n
C5 330p
C6 470u/40V
C8 10u/35V
C10 470u/40V
C11 10u/35V
C7 100n
C25 100n
C26 100n
C27 100n
C28 100n
C31 100n
C32 100n
C33 100n
C34 100n
R1 6K81
R2 4K32
R3 15K0
R4 4K42
R5 2K21
R6 3K32
R9 1K0
R10 90R9
R11 3K32
R33 3K32
RN5-A 10K0
RN5-C 10K0
RN5-D 10K0
RN6-H 10k
TP1
TP7
TP8
TP9
TP10
TP13
X38-17
X38-18
X38-19
X38-20
X38-22
X38-23
X38-25
X38-26
X35-3
X35-2
X35-4
X35-6
X35-5
X38-14
X38-11
X38-15
X38-24
TEMPFAIL
EXPENA
KVOK
TUBEFAIL


INSTRUMENTARIUM IMAGING
FILAMENT CONTROL BOARD

N3300 / N3301 Inverter Board

N3300 - for tubehead s/n **90-----**.
N3301 - for tubehead s/n **91-----**.
IMPORTANT NOTE:
N3300 and N3301 are **NOT** interchangeable.

N3300 / N3301 Location

Inside the rotating unit, in the tubehead side.
To access remove the tubehead cover, head support assembly and the inner cover of the rotating unit.

N3300 / N3301 Field replaceable parts

Fuse
F1 10AT/250VAC 6.3 x 32mm (UL C/A, code 3600008).

WARNING
Replace only with the same type and rating of fuse.

N3300 / N3301 Description

The Inverter Board produces the high frequency voltage for the tubehead. This is done by chopping the incoming 310Vdc with an H-bridge and driving it to a high frequency transformer on the Tubehead Board. The transformer multiplies the voltage.
The tubehead voltage is controlled with voltage reference from the CPU and voltage feedback from the Tubehead Board.

The H-bridge is controlled by comparing the voltage reference from the CPU and the feedback from the Tubehead Board and adjusting the difference to zero. Driving the high voltage H-bridge is done with half bridge drivers and high frequency transformers. The operating frequency depends on the power and it is between 35-88 kHz so that higher power is at a lower frequency. The board also has a shutdown function if something goes wrong.

N3300 Indicator LEDs

LED	Colour	Description
H1	green	+310Vdc
H2, H3	red	H-bridge current
H4	red	kVok
H5	green	+15V on
H6	red	Exposure
H7	green	+25V on
H8, H9	red	H-bridge pulses a
H10-11	red	H-bidge pulses b

N3300 Test points

TP	Signal	Description
TP1	+310VGND	
TP2	+310Vdc	
TP3	H-bridge output 2	
TP4	H-bridge output 1	
TP13	H-bridge pulses a	
TP14	Shutdown	
TP15	H-bridge pulses b	
TP16	GND	
TP17	GND	
TP18	Voltage feedback	
TP19	Voltage reference	
TP20	GND	
TP21	H-bridge driver 2 high	
TP22	H-bridge driver 2 low	
TP23	H-bridge driver 1 high	
TP24	H-bridge driver 1 low	

N3300 Connectors

Connector X30

Pin	Signal	Description
1	+310Vdc	Power supply voltage
2	+310VGND	Ground for +310Vdc

Connector X31

Pin	Signal	Description
1	1	H-bridge output 2
2	2	H-bridge output
3	3	H-bridge output 1
4	4	H-bridge output 1

Connector X32

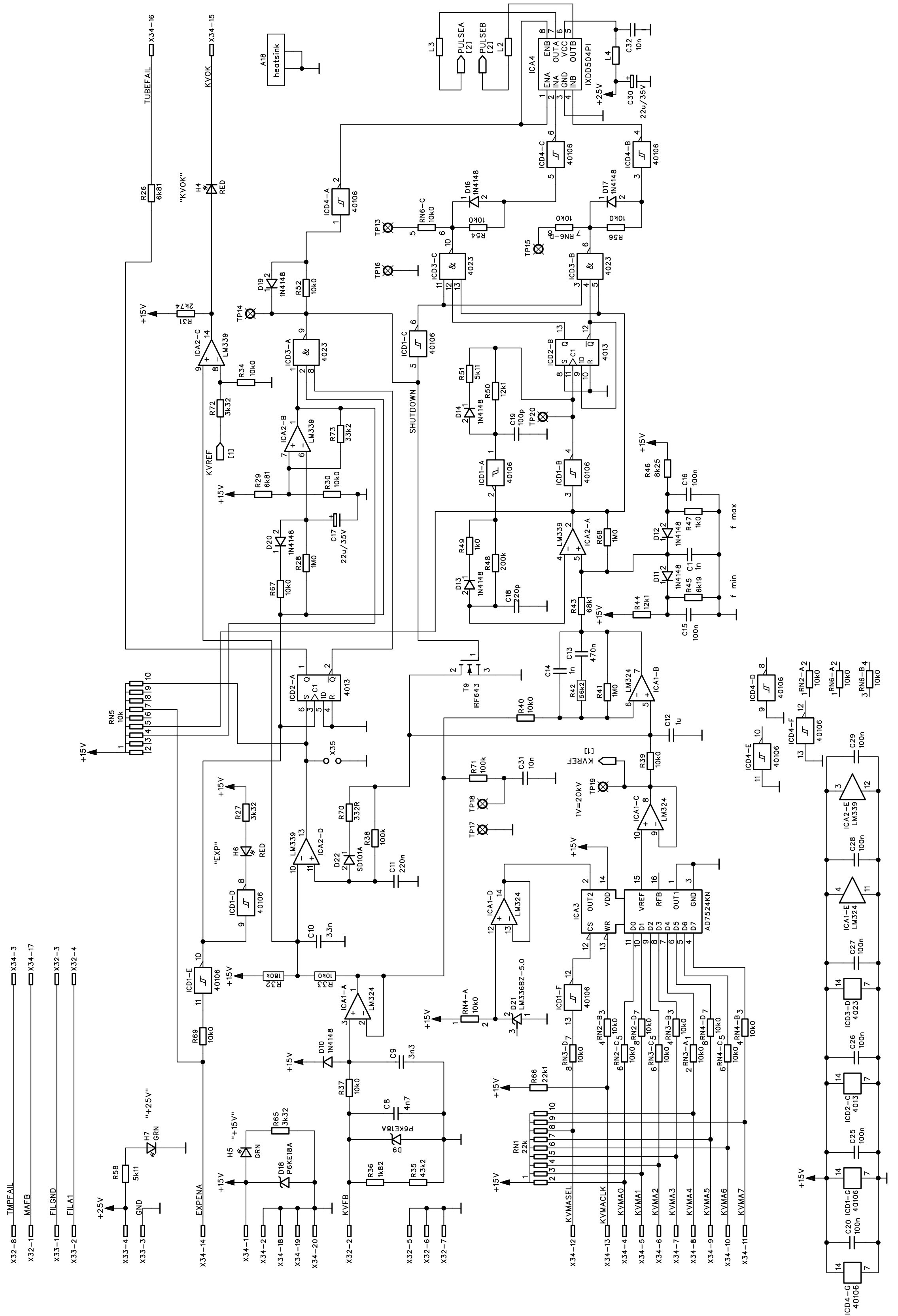
Pin	Signal	Description
1	mAfb	Current feedback
2	kVfb	Voltage feedback
3	-	Not used
4	-	Not used
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	Tmpfail	Temperature too high

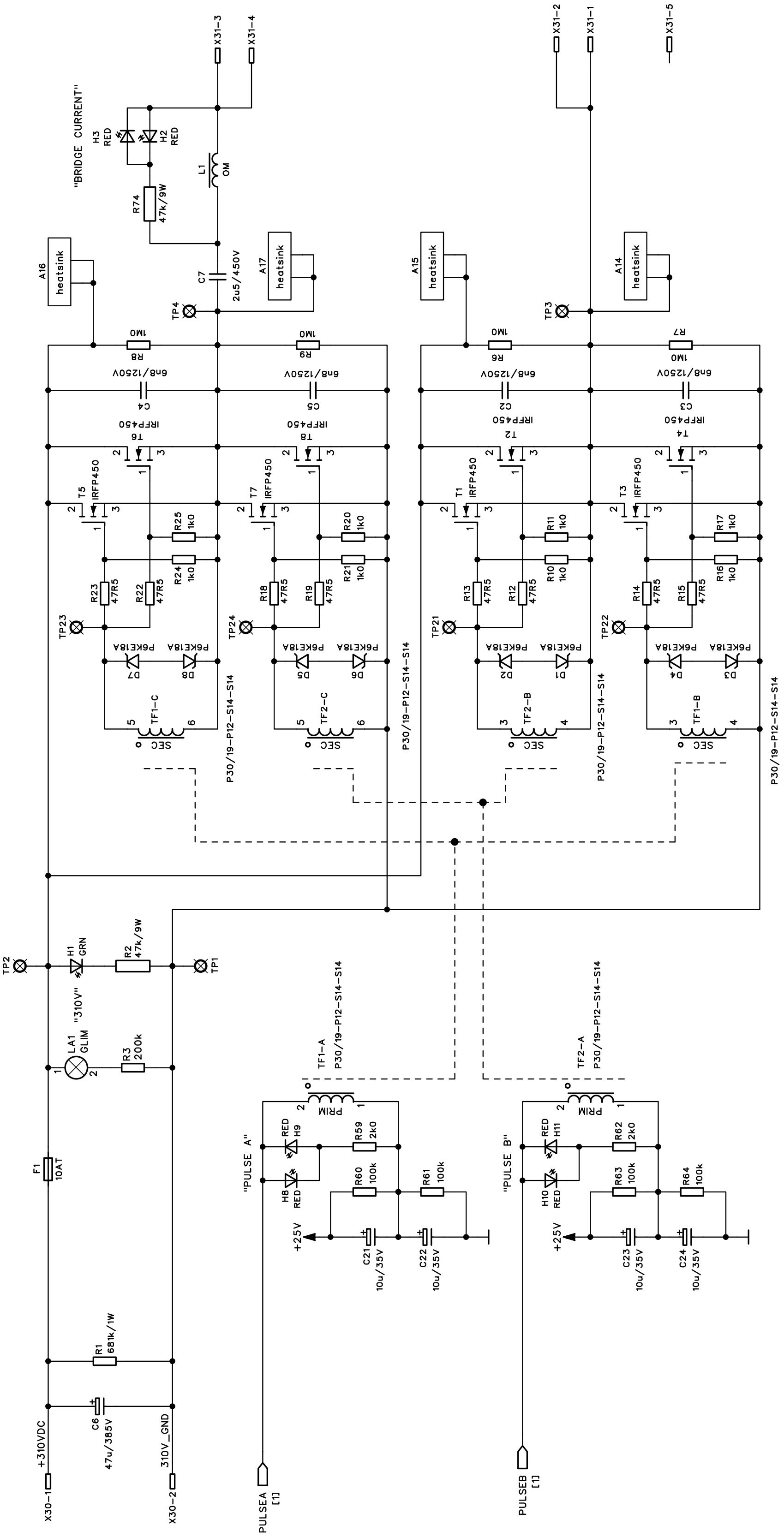
Connector X33

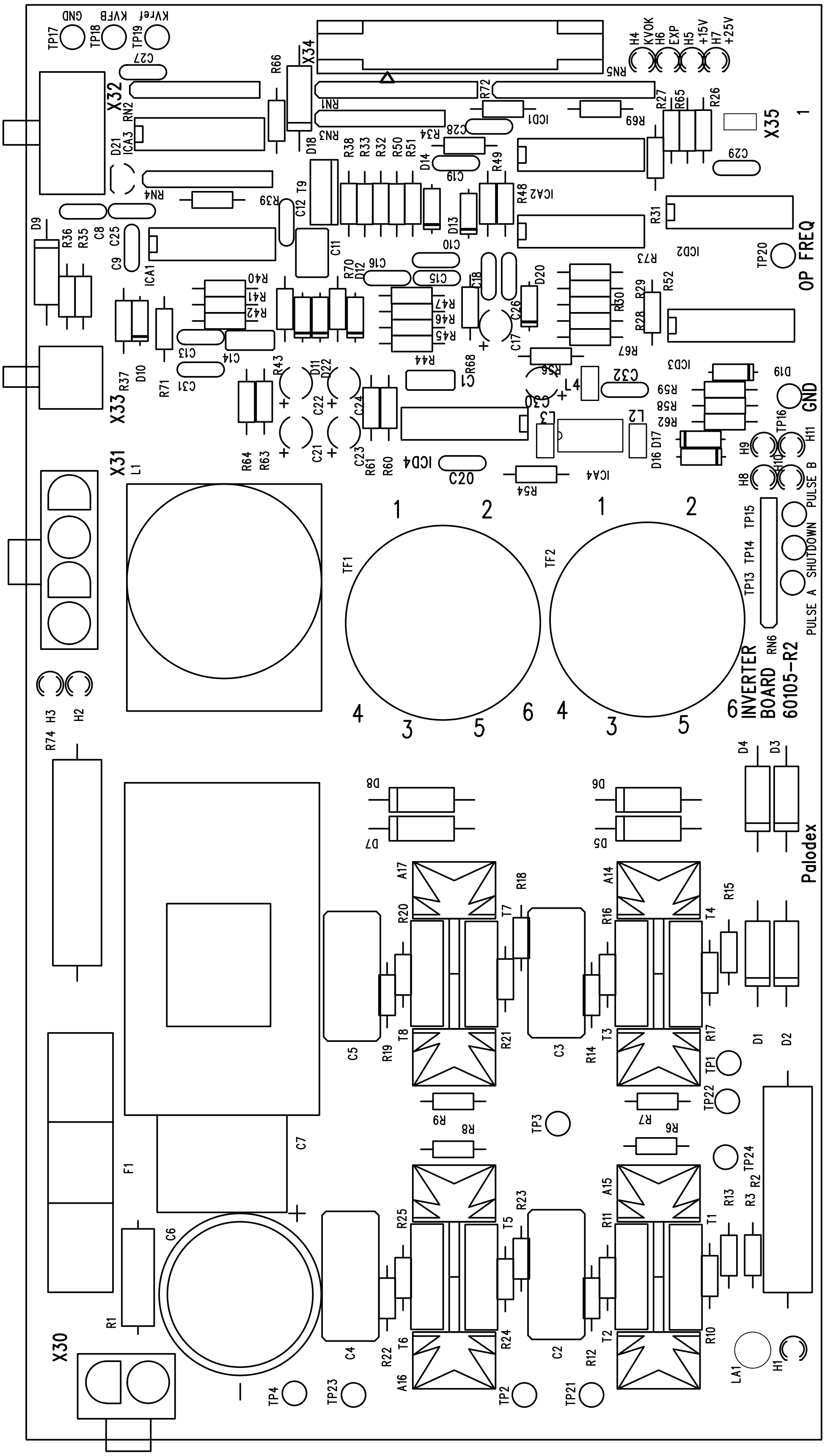
Pin	Signal	Description
1	FilGND	Filament ground
2	Fila1	Filament transformer control
3	GND	Ground
4	+25V	Power supply voltage

Connector X34

Pin	Signal	Description
1	+15V	Power supply voltage
2	GND	Ground
3	Tmpfail	Temperature too high
4	kVmA0	Digital kV and mA references
5	kVmA1	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA3	Digital kV and mA references
8	kVmA4	Digital kV and mA references
9	kVmA5	Digital kV and mA references
10	kVmA6	Digital kV and mA references
11	kVmA7	Digital kV and mA references
12	kVmAsel	Select kV or mA
13	kVmAclk	Clock
14	Expena	Exposure enable
15	kVok	KV control is ok
16	Tubefail	Failure in tubehead
17	mAfb	Current feedback
18	GND	Ground
19	GND	Ground
20	GND	Ground




X31-3
X31-4
X31-2
X31-1
X31-5
"BRIDGE CURRENT"
heatsink
A16
A17
A15
A14
"310V"
"PULSE A"
"PULSE B"
+310VDC
310V_GND
X30-1
X30-2
PULSEA [1]
PULSEB [1]


INVERTER
BOARD
60105-R2
Palodex
OP FREQ
GND
PULSE A
SHUTDOWN
PULSE B
KVref
KVFB
KVOK
EXP
+15V
+25V
X30
X31
X32
X33
X34
X35
TF1
TF2

N3500 Motor Controller board

N3500 Location

Inside the vertical carriage.
To access remove the vertical carriage front cover. If needs to be removed, remove also the plastic decoration on the rear of upper shelf and the z-carriage right hand side cover.

N3500 Field replaceable parts

Z-motor fuse (6.3mm x 32mm, UL C/A)
- 2AT, 250Vac at 230Vac mains, code 3600031
- 4AT, 250Vac at 115Vac mains, code 3600065

Mains fuse F1 and F2 (6.3mm x 32mm, UL C/A):
- 8AT, 250Vac at 230Vac mains, code 3600013
- 15AT, 250Vac at 115Vac mains, code 20045

WARNING
Replace fuses only with the same type and rating of fuses.

WARNING: HIGH VOLTAGE
The board is connected to the main power supply. Disconnect the main power supply before touching the board.
If plastic shield on the board is removed, make sure that it is replaced.

N3500 Description

Motor Controller Board includes the control electronics for stepper motors (rotation, collimator and y - layer) and AC z-motor .
The board includes also a mains fuse and mains over-voltage protection varistors.

N3500 Indicator LEDs

LED	Colour	Description
D1 - 4	green	Collimator motor drive pulses
D10	green	Incoming supply voltage +34V
D11	green	+15V
D12	green	Incoming supply voltage +5V
D23	green	zena1 (from z-buttons)
D24	green	zena (from cpu)
D25	green	estop_5v
D35 - D36, D38 - D39	green	Linear motor drive pulses
D50-53	green	Rotation motor drive pulses

N3500 Test points

TP	Signal	Description
TP1		Incoming supply voltage +34V
TP2	+15V	
TP3		Incoming supply voltage +5V
TP4	GND	
TP5	casclk	Collimator stepper motor clock
TP6	casdir	Collimator stepper motor direction
TP7	casena	Collimator stepper motor enable
TP8	linclk	Y-layer stepper motor clock
TP9	lindir	Y-layer stepper motor direction
TP10	linena	Y-layer stepper motor enable
TP11	rotclk	Rotation stepper motor clock
TP12	rotdir	Rotation stepper motor direction
TP13	rotena	Rotation stepper motor enable
TP14	zdir	Z-motor direction
TP15	zena	Z-motor enable
TP16	zena1	Z-motor enable
TP17	GND	

N3500 Jumpers

JP1	Selects emegency stop. - Jumper = pan unit, - No jumper = pan/ceph unit
JP2	Z-movement selection. Factory set on pins 2 and 3. DO NOT MOVE.

N3500 Connectors

Connector J3502

Pin	Signal	Description
1	GND	Ground
2	+34V	Power supply voltage
3	GND	Ground
4	+34V	Power supply voltage
5	ESTOP1_5V	Estop-voltage loop to/from ceph head
6	ESTOP_5V	Estop-voltage loop to/from ceph head
7	ZENA1-	Z movement enable1
8	-	Not used
9	-	Not used
10	-	Not used

Connector J3504

Pin	Signal	Description
1	+34V	Power supply voltage
2		Patient position light enable

Connector J3505

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LINDIR	Linear movement direction
4	LINENA	Linear movement enable
5	CASDIR	Collimator movement direction
6	CASENA	Collimator movement enable
7	ROTENA	Rotation movement enable
8	ROTDIR	Rotation movement direction
9	-	Not used
10	-	Not used
11	LINCLK	Linear movement clock
12	CASCLK	Collimator movement clock
13	ROTCLK	Rotation movement clock
14	ZENA	Z-movement enable
15	ZDIR	Z-movement direction
16	-	Not used
17	-	Not used
18	PROJLIT	Patient position light enable
19	WARNLIGHT	Exposure warning light

20	XRAYLIT	Exposure warning light
21	-	Not used
22	OUT4	Not used
23	OUT5	Not used
24	ZENA1-	Z movement enable1
25	GND	Ground
26	GND	Ground

Connector J3506

Pin	Signal	Description
1	CAS1	Phase1 for collimator movement motor
2	CAS2	Phase2 for collimator movement motor
3	CAS3	Phase3 for collimator movement motor
4	CAS4	Phase4 for collimator movement motor
5	LIN1	Phase1 for Y-layer movement motor
6	LIN2	Phase2 for Y-layer movement motor
7	LIN3	Phase3 for Y-layer movement motor
8	LIN4	Phase4 for Y-layer movement motor
9	ROT1	Phase1 rotation movement motor
10	ROT2	Phase2 rotation movement motor
11	ROT3	Phase3 rotation movement motor
12	ROT4	Phase4 rotation movement motor
13	-	Not used
14	-	Not used
15	-	Not used
16	-	Not used
17	PROLIT	Patient position light enable
18	MIRROR-	Patient mirror locked
19	-	Not used
20	-	Not used
21	+34V	Power supply voltage
22	GND	Ground
23	+34V	Power supply voltage
24	GND	Ground
25	+34V	Power supply voltage
26	GND	Ground

Connector J3507

Pin	Signal	Description
1	+34V	Power supply voltage
2		Patient position light enable

Connector J3508

Pin	Signal	Description
1	Z_MOVE1	
2	-	Not used
3	Z_AC2	
4		
5	-	Not used
6	Z_MOVE2	
7	-	Not used
8	Z_AC2	

Connector J3509

Pin	Signal	Description
1	AC1	AC-voltage

Connector J3510

Pin	Signal	Description
1	AC2	AC-voltage

Connector J3511

Pin	Signal	Description
1	AC1	AC-voltage

Connector J3512

Pin	Signal	Description
1	AC2	AC-voltage

Connector J3514

Pin	Signal	Description
1	MIRROR-	Patient mirror locked
2	GND	Ground

Connector J3515

Pin	Signal	Description
1	L	AC-voltage

Connector J3516

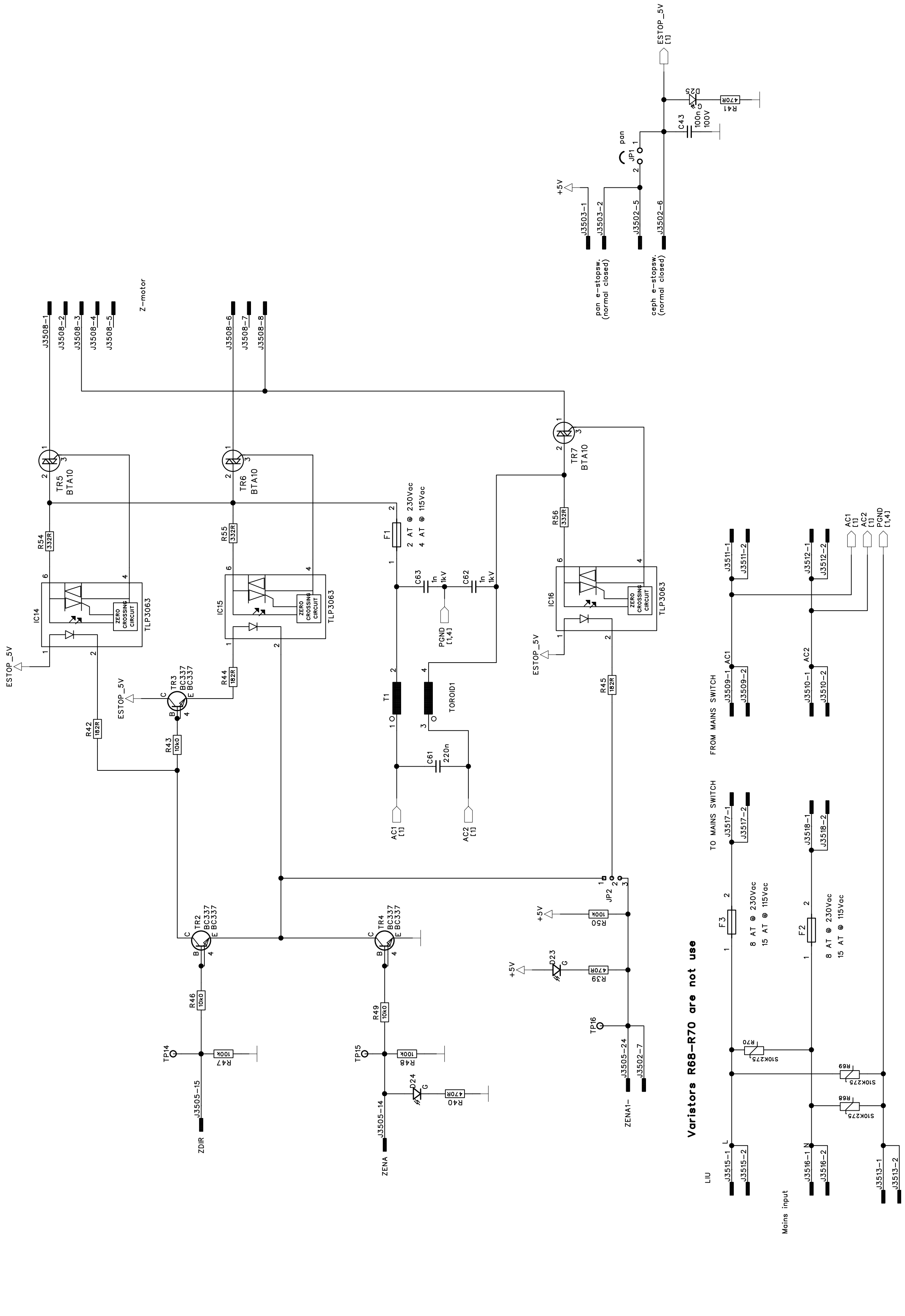
Pin	Signal	Description
1	N	AC-voltage

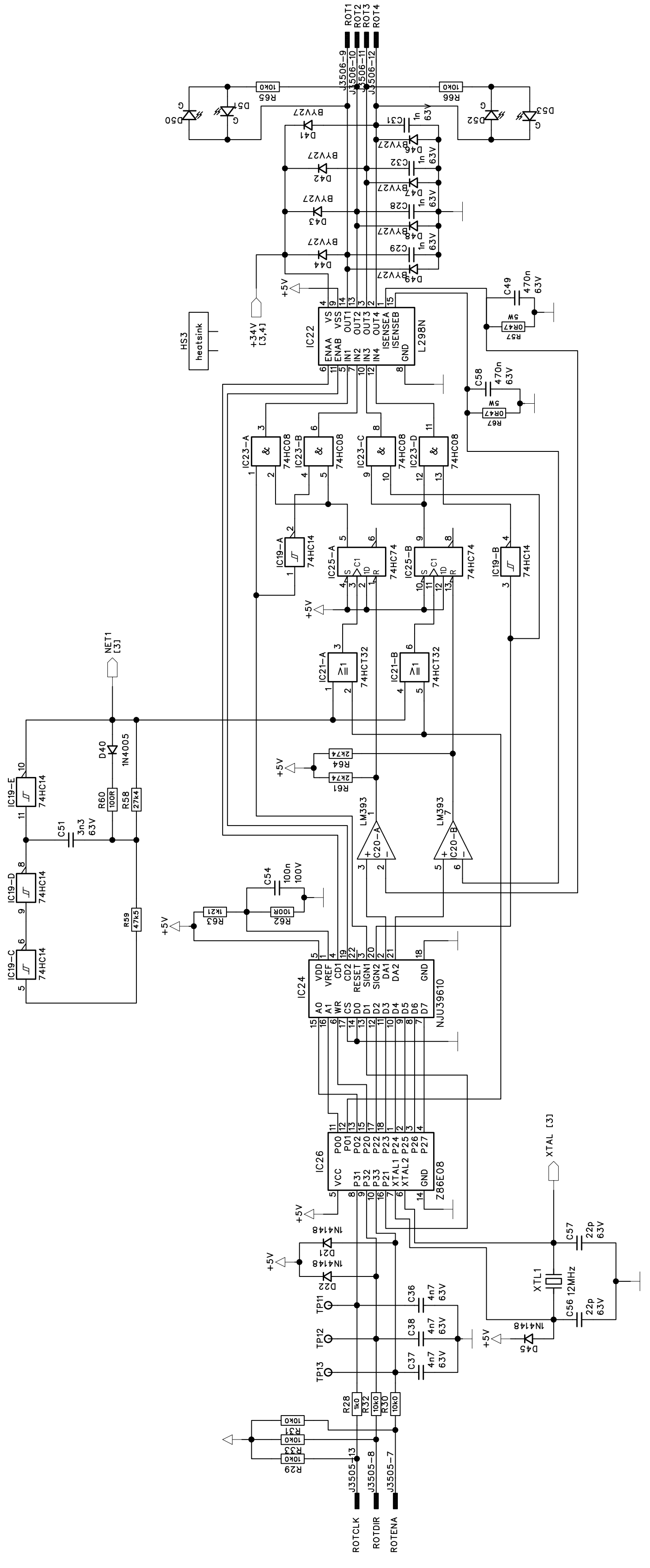
Connector J3517

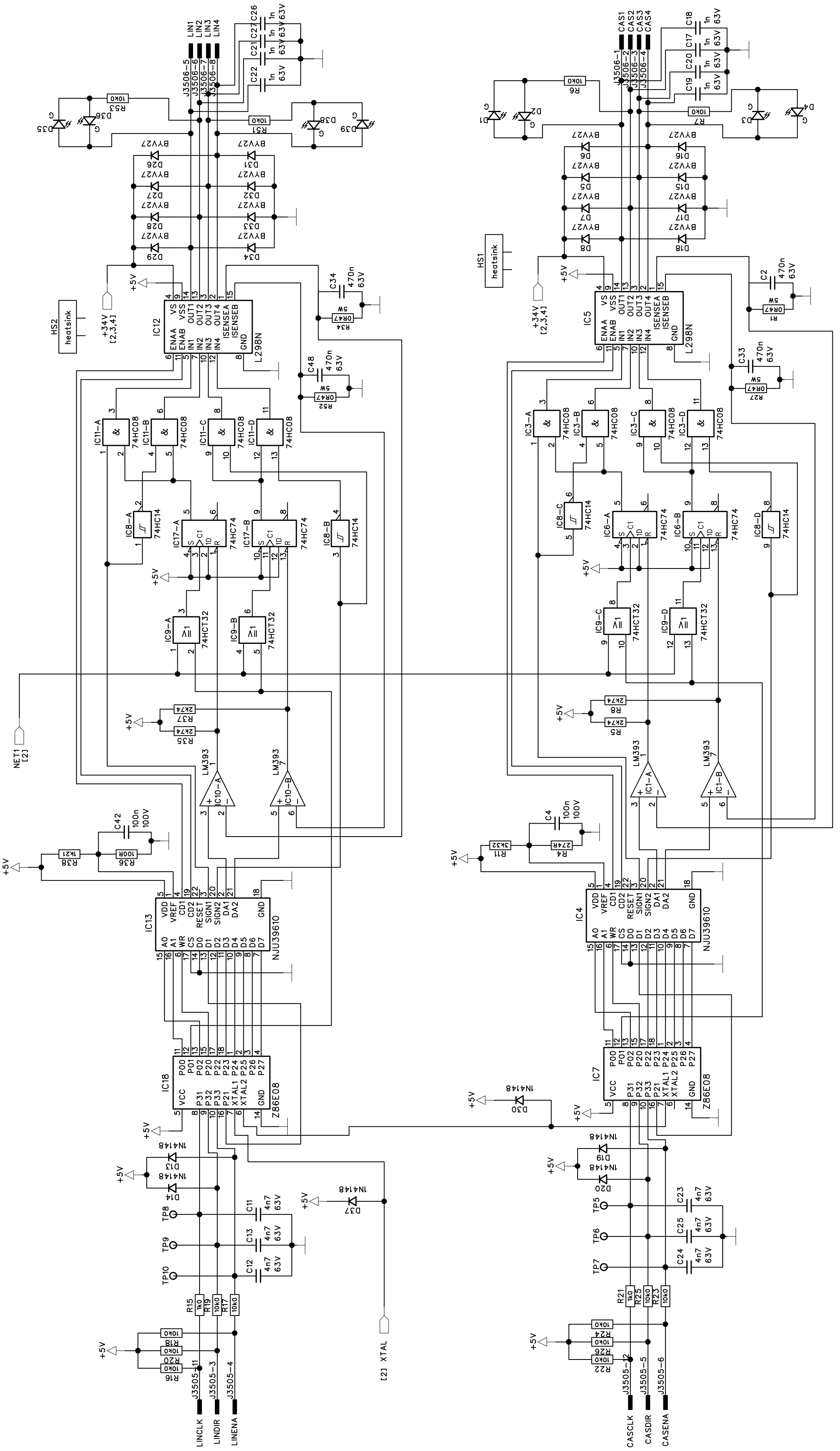
Pin	Signal	Description
1	L	AC-voltage

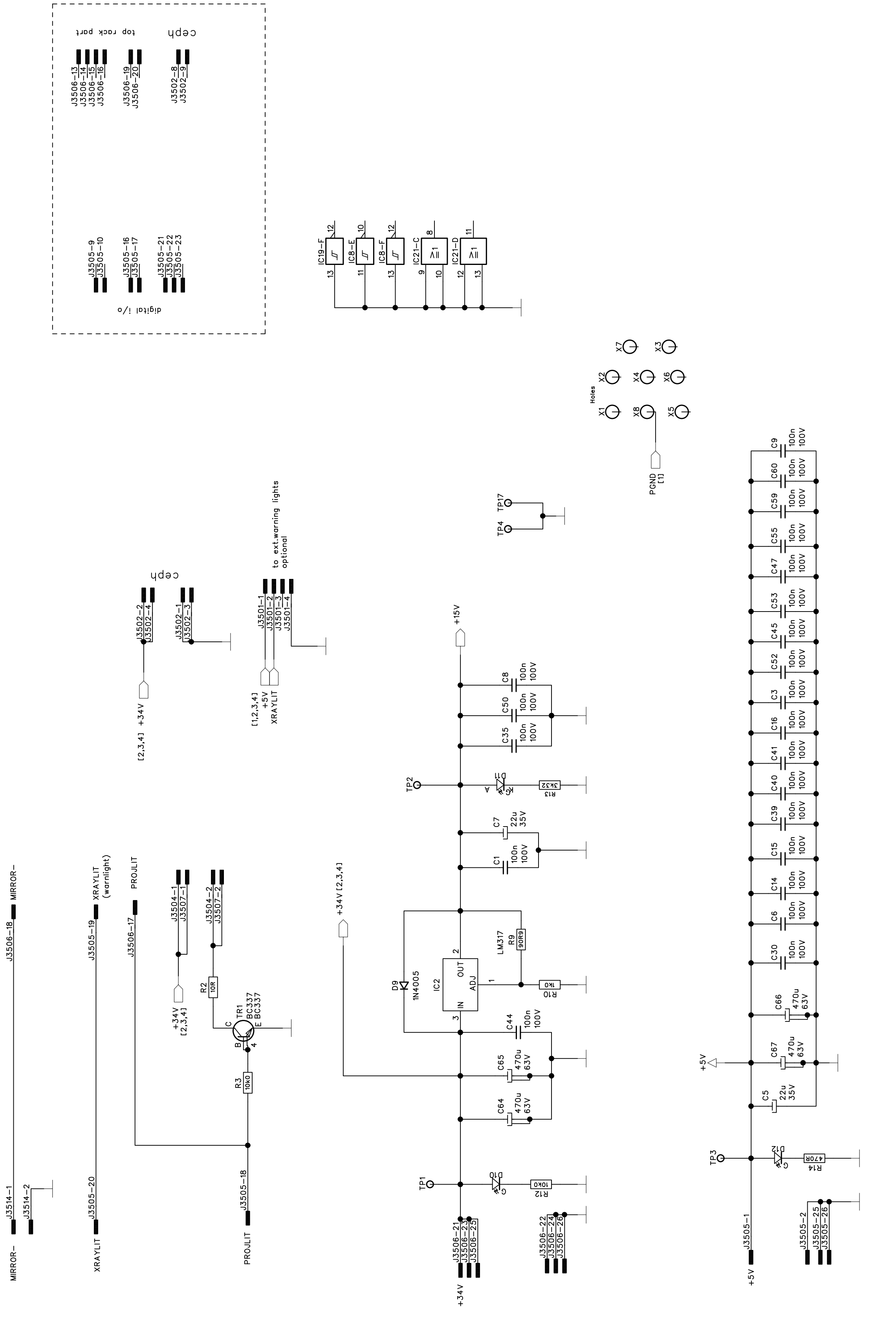
Connector J3518

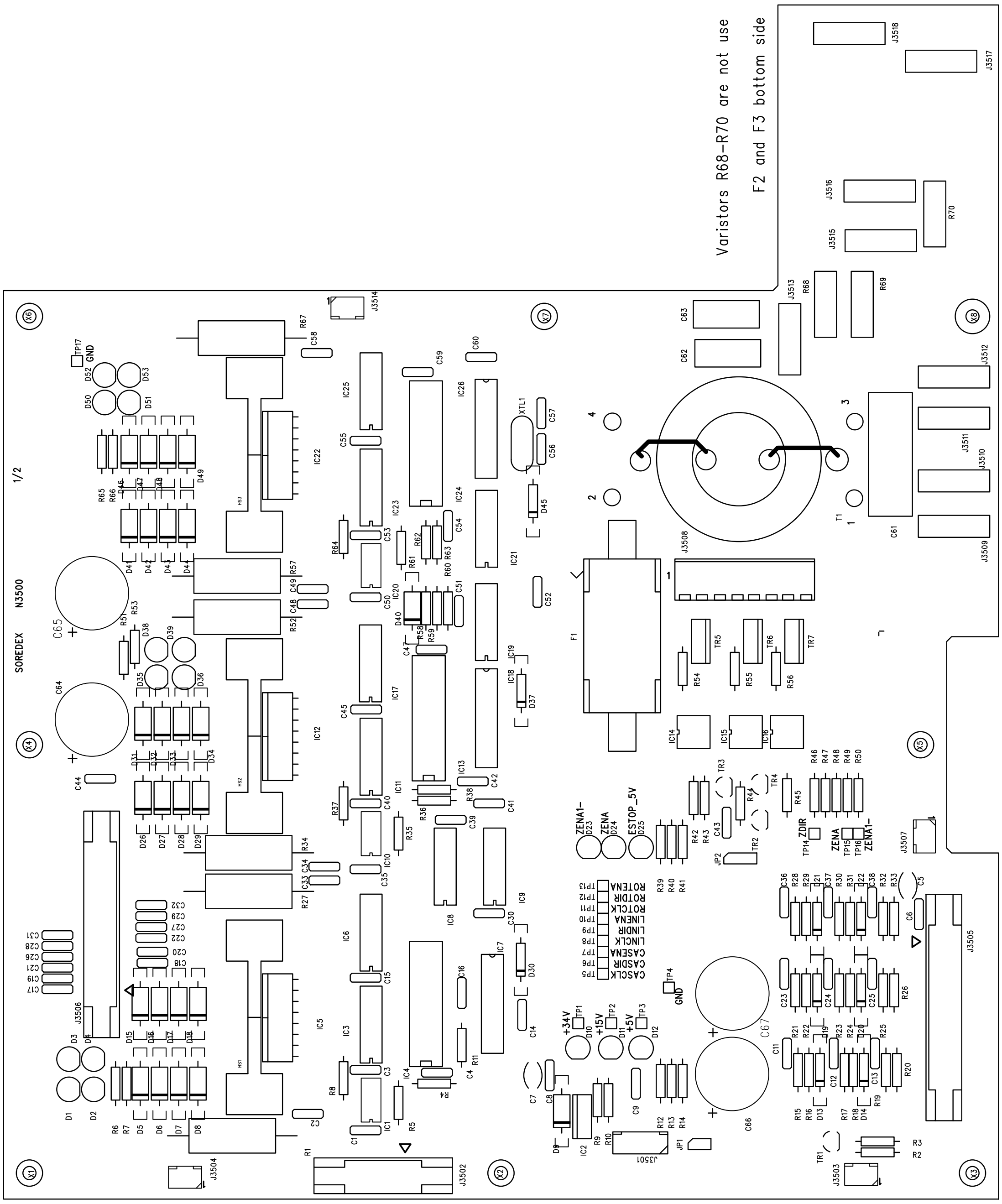
Pin	Signal	Description
1	N	AC-voltage


Z-motor
FROM MAINS SWITCH
TO MAINS SWITCH
Mains input
Varistors R68–R70 are not use









N3600 / N3700 - N3601 / N3701 Control Panel

N3600 / N3700 - versions with s/n **B81642 and earlier**.
N3601 / N3701 - versions with s/n **B91643 and later**.
IMPORTANT NOTE:
N3600 / N3700 and N3601 / N3701 are **NOT** interchangeable.

N3600(1) / N3700(1) Location

In the vertical-carriage.
To access, remove the z-carriage front cover and the left-hand-side cover.

N3600(1) / N3700(1) Field replaceable parts

None.

N3600(1) / N3700(1) Description

Control Panel serves as a link between the user and the CPU board. It consist of a Max 6954 circuit which controls the 7-segment displays on the attached N3700 Display board, the indicator LEDs and switches of N3700 board. The control panel allows the user to operate the panoramic unit and aso displays the status of the unit. The Control Panel is monitored and controlled from the CPU Board by a serial link (3 input lines and one output line).
NOTE:
The control panel also includes four non-visible service buttons that only function when the service connector is in place.

N3600(1) / N3700(1) Connectors:

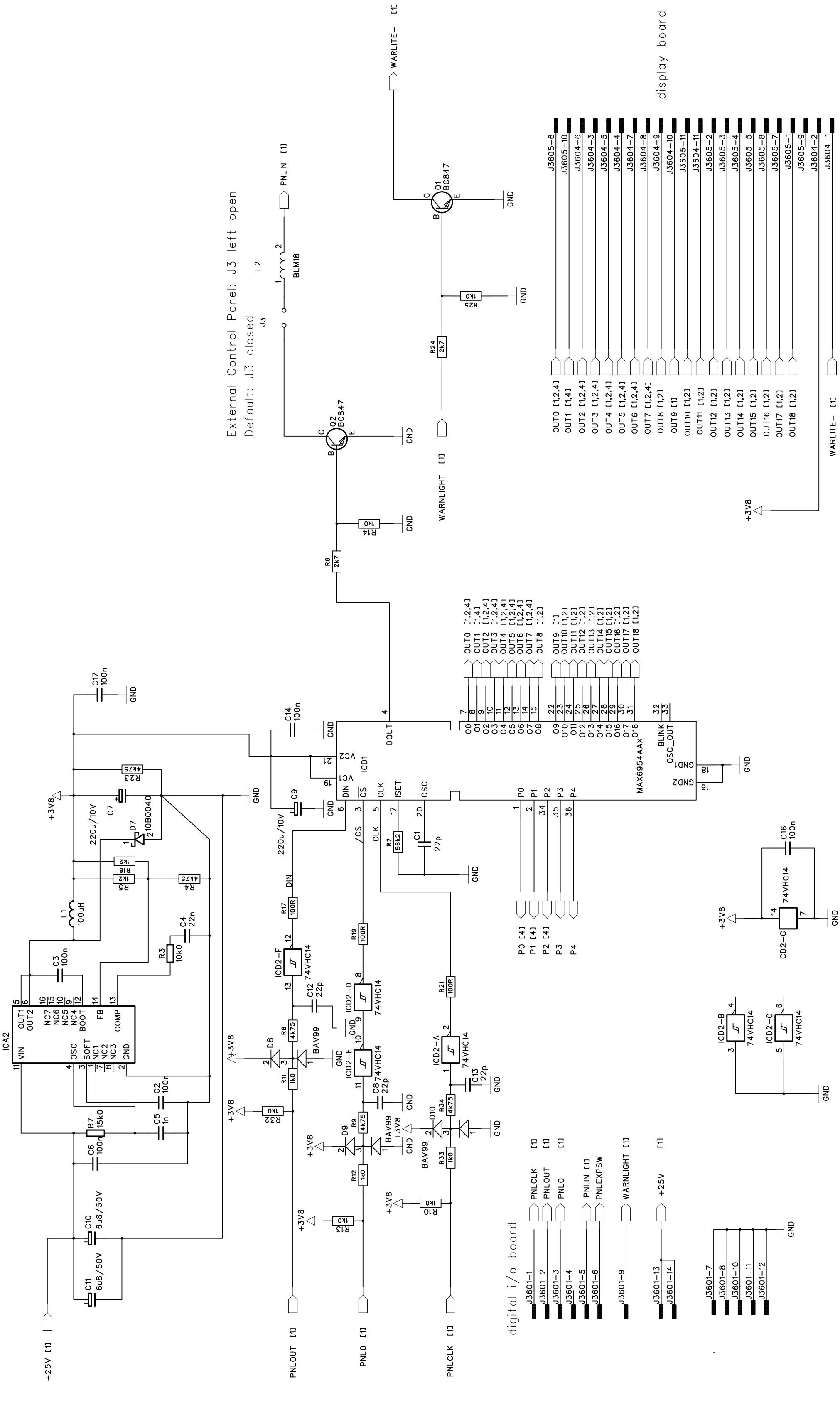
Connector J3601

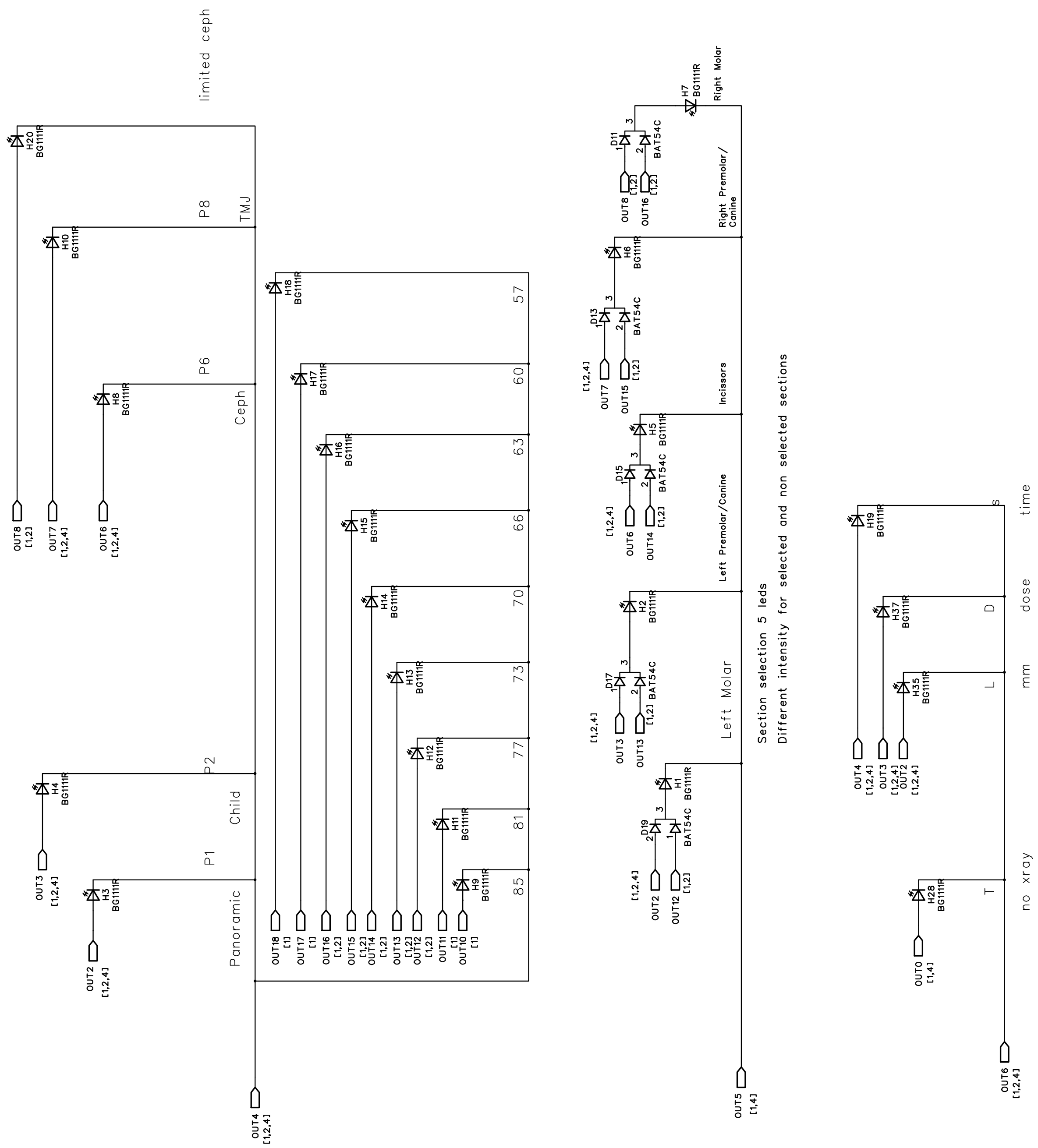
Pin	Signal	Description
1	PNLCLK	Control panel clock
2	PNLOUT	Ccntrol panel enable
4	-	Not used
5	PNLIN	Control panel data in
6	-	Not used
7	GND	Ground
8	GND	Ground
9	WARNLIGHT	Exposure warning light
10	GND	Ground

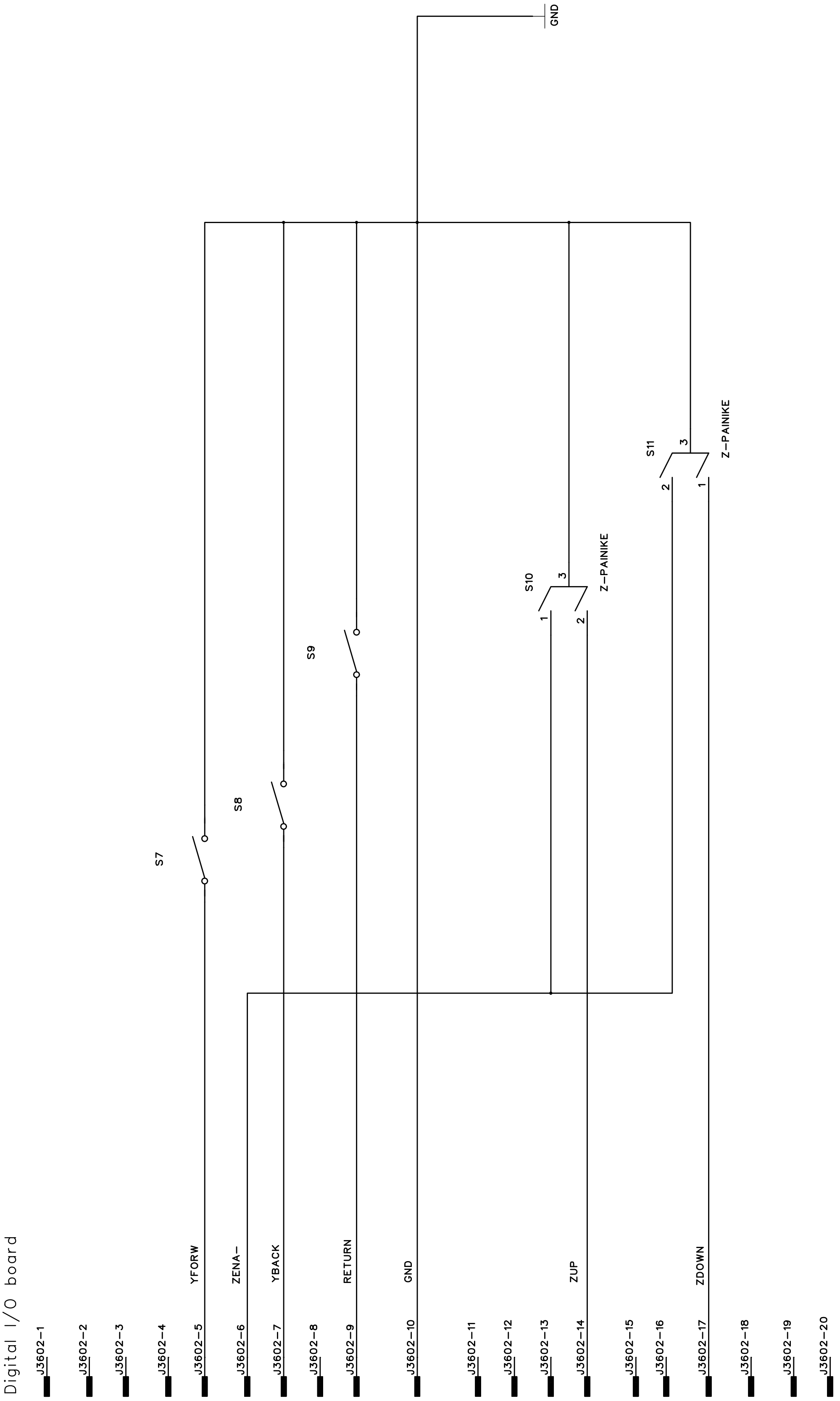
11	GND	Ground
12	GND	Ground
13	+25V	Power supply voltage
14	+25V	Power supply voltage

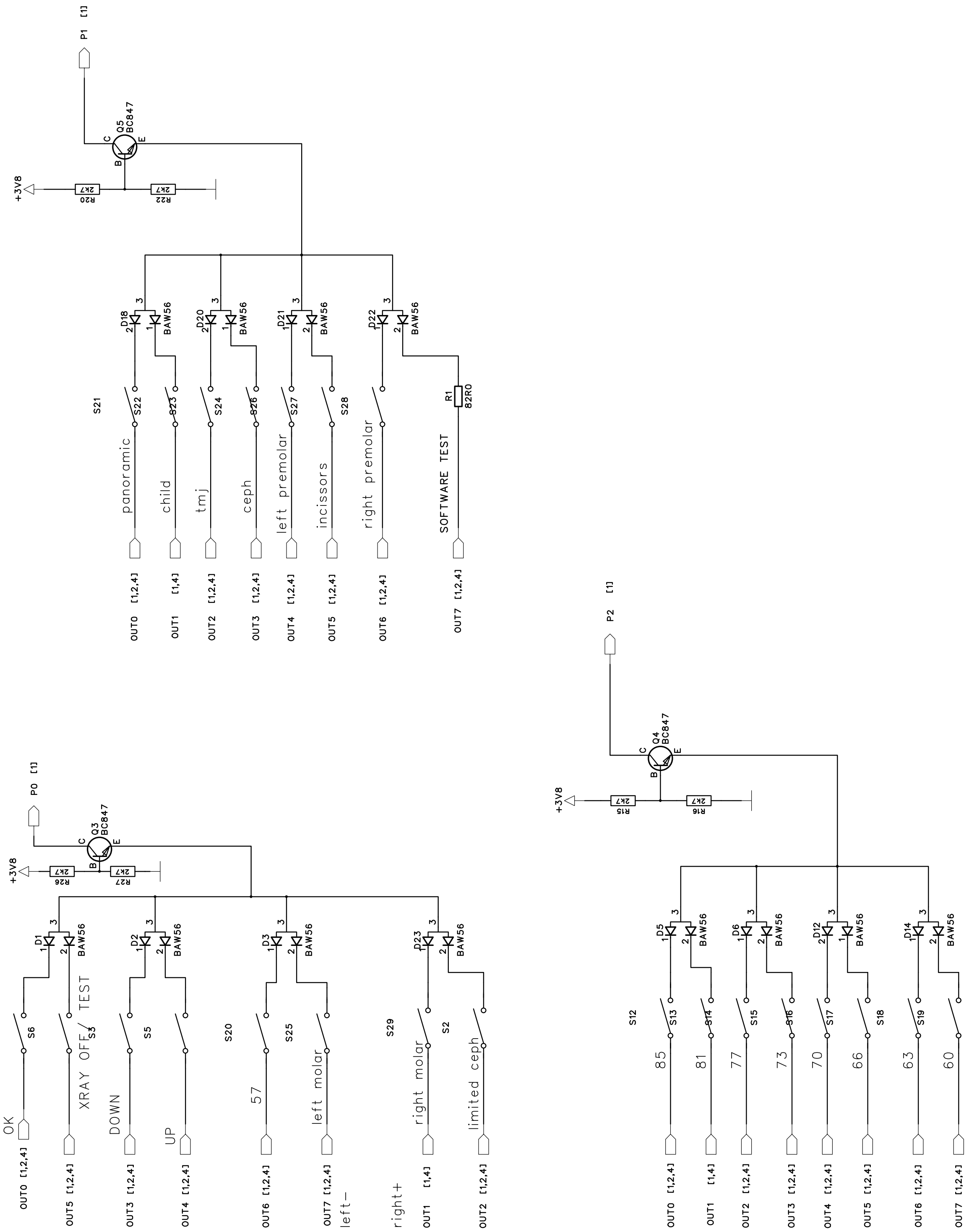
Connector J3602

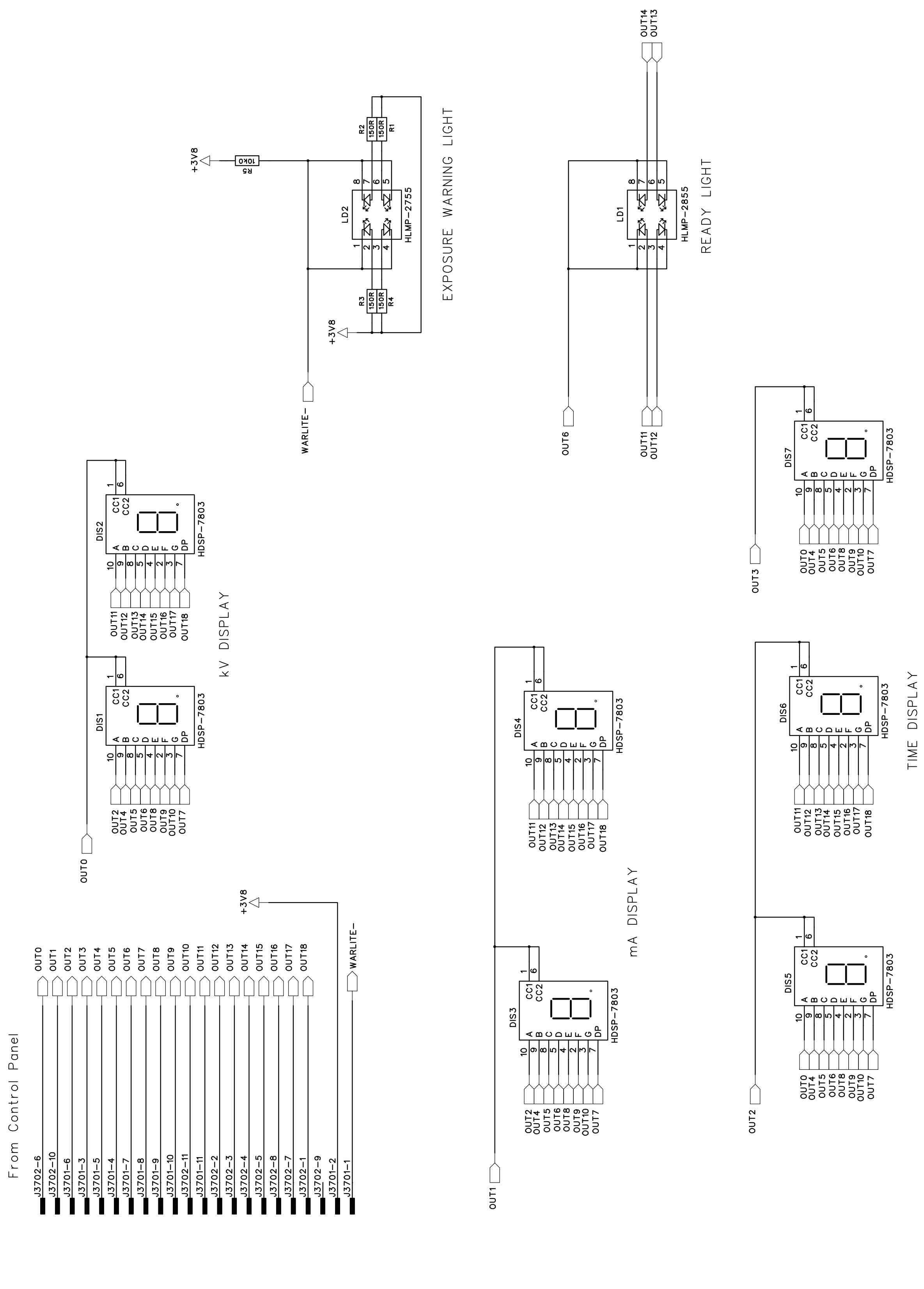
Pin	Signal	Description
1	+5V	Power supply voltage
2	-	Not used
3	-	Not used
4	-	Not used
5	YFORW	Y-layer movement forward
6	ZENA1-	Z movement enable1
7	YBACK	Y-layer movement back
8	-	Not used
9	RETURN	Return
10	GND	Ground
11	-	Not used
12	-	Not used
13	-	Not used
14	ZUP	Z movement up
15	-	Not used
16	-	Not used
17	ZDOWN	Z movement down
18	-	Not used
19	-	Not used
20	GND	Ground


External Control Panel: J3 left open
Default: J3 closed
display board
digital i/o board
MAX6954AAX


limited ceph
TMJ
P8
Ceph
P6
Child
P2
P1
Panoramic
57
60
63
66
70
73
77
81
85
Right Molar
Right Premolar / Canine
Incissors
Left Premolar/Canine
Left Molar
Section selection 5 leds
Different intensity for selected and non selected sections
time
dose
mm
no xray
s
D
L
T
BG1111R
BAT54C
OUT4 [1,2,4]
OUT5 [1,4]
OUT6 [1,2,4]
OUT0 [1,4]


GND
S11
Z-PAINIKE
S10
Z-PAINIKE
S9
S8
S7
Digital I/O board
YFORW
ZENA-
YBACK
RETURN
GND
ZUP
ZDOWN
J3602-1
J3602-2
J3602-3
J3602-4
J3602-5
J3602-6
J3602-7
J3602-8
J3602-9
J3602-10
J3602-11
J3602-12
J3602-13
J3602-14
J3602-15
J3602-16
J3602-17
J3602-18
J3602-19
J3602-20


P1
Q5 BC847
+3V8
R20 2k7
R22 2k7
D18 BAW56
D20 BAW56
D21 BAW56
D22 BAW56
R1 82R0
S21
S22
S23
S24
S26
S27
S28
panoramic
child
tmj
ceph
left premolar
incissors
right premolar
SOFTWARE TEST
OUT0 [1,2,4]
OUT1 [1,4]
OUT2 [1,2,4]
OUT3 [1,2,4]
OUT4 [1,2,4]
OUT5 [1,2,4]
OUT6 [1,2,4]
OUT7 [1,2,4]
P2
Q4 BC847
R15 2k7
R16 2k7
D5 BAW56
D6 BAW56
D12 BAW56
D14 BAW56
S12
S13
S14
S15
S16
S17
S18
S19
85
81
77
73
70
66
63
60
P0
Q3 BC847
R26 2k7
R27 2k7
D1 BAW56
D2 BAW56
D3 BAW56
D23 BAW56
S1
S6
S3
S5
S20
S25
S29
S2
OK
XRAY OFF / TEST
DOWN
UP
57
left molar
right molar
limited ceph
left-
right+


EXPOSURE WARNING LIGHT
READY LIGHT
kV DISPLAY
mA DISPLAY
TIME DISPLAY
From Control Panel
HLMP-2755
HLMP-2855
HDSP-7803
WARLITE-
+3V8

N3800 Rotation Position Sensor

N3800 Location

Inside the rotating unit (C-arm).
To access remove the pan head support assembly and rotating unit lower covers covers beneath the rotating unit.

N3800 Field replaceable parts

None.

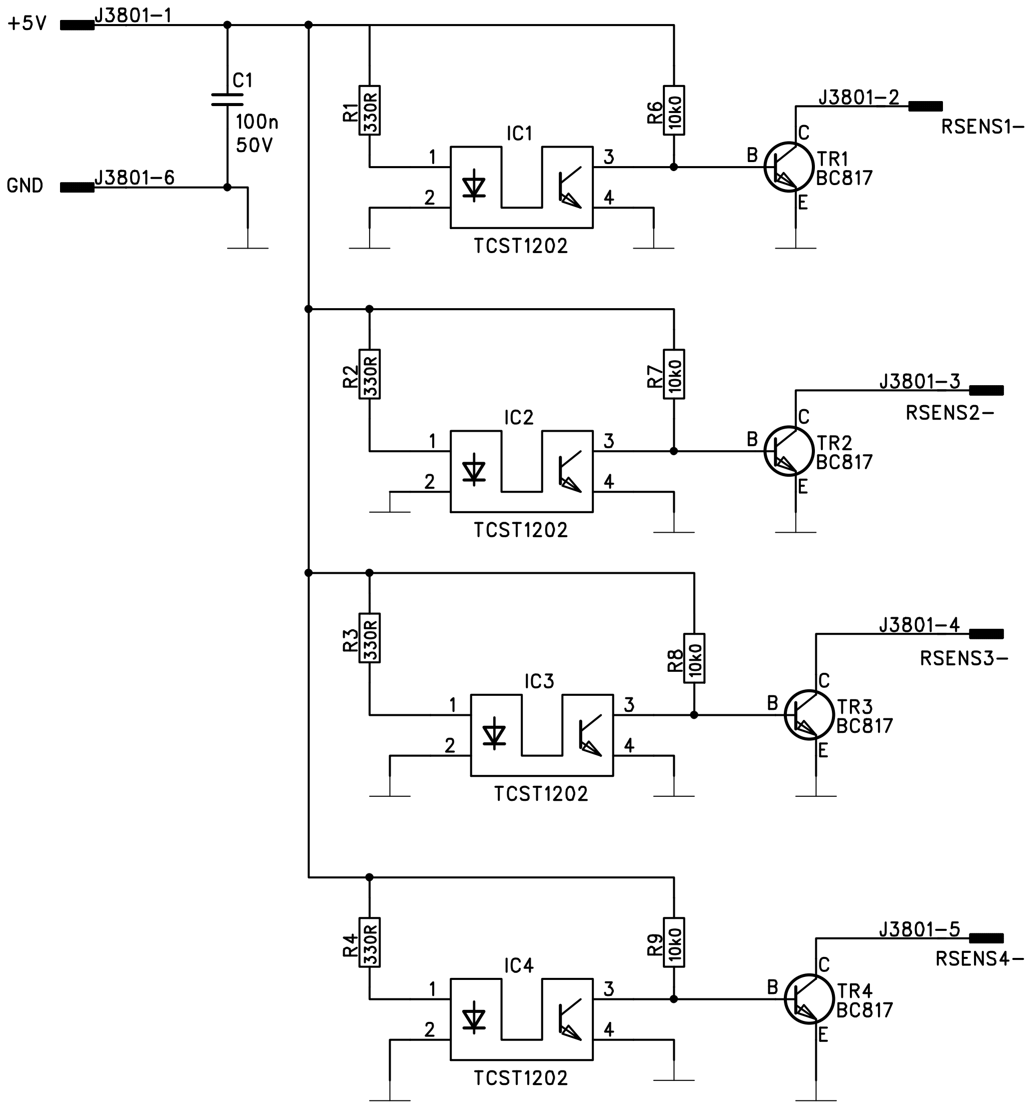
N3800 Description

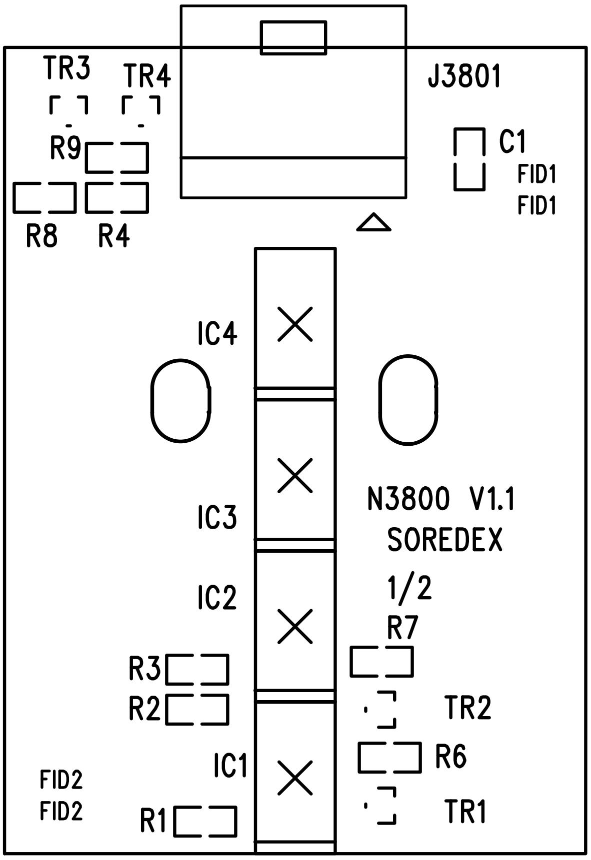
The N3800 board comprises three optosensors that are used to detect the rotational position of the C-arm. The signals from the three sensors are RSENS1*- RSENS3*. Each optosensor comprises a transmitter LED, and a receiver, or base. The sensor signals remain on as long as the base receives light from the LED. If the light beam to the base is cut off, for example by the positioning rail, the sensor signal is switched off.

N3800 Connectors

Connector J3801

Pin	Signal	Description
1	+5V	Power supply voltage
2	ROT1SW	Rotation movement sensor1
3	ROT2SW	Rotation movement sensor2
4	ROT3SW	Rotation movement sensor3
5	ROT4SW	Rotation movement sensor4
6	GND	Ground


+5V
J3801–1
C1
100n
50V
GND
J3801–6
R1
330R
R6
10k0
IC1
TCST1202
J3801–2
RSENS1–
TR1
BC817
R2
330R
R7
10k0
IC2
TCST1202
J3801–3
RSENS2–
TR2
BC817
R3
330R
R8
10k0
IC3
TCST1202
J3801–4
RSENS3–
TR3
BC817
R4
330R
R9
10k0
IC4
TCST1202
J3801–5
RSENS4–
TR4
BC817


TR3
TR4
J3801
R9
C1
FID1
FID1
R8
R4
IC4
IC3
N3800 V1.1
SOREDEX
1/2
IC2
R7
R3
R2
TR2
IC1
R6
FID2
FID2
R1
TR1

N4100 Position Lights

N4100 Location

There are three N4100 boards in the unit. They are attached to the z-carriage (horizontal light, center light) and one in the rotating part (focal trough=layer light).

N4100 Field serviceable parts

None

N4100 Description

Position lights board consists of 3 LEDs in series.

N4100 Indicator LEDS

None.

N4100 Test pins

None.

N4200 Ceph Connector Board

N4200 Location

On the ceph head.
To access remove ceph head cover.

N4200 Field replaceable parts

None.

N4200 Description

The Ceph Connector Board includes connectors that allow the ceph head be removed easily from the ceph arm and electronics to convert the patient's head size to a frequency that the CPU can use to select the correct kV (Auto-kV).
The measurement of the patient's head size is implemented using a AD654 V/f-converter. The circuit allows a min. 4 volts lower voltage in its input than the supply voltage (+5V). Because of this, there is an emitter follower that generates the required voltage (+1V).
A potentiometer slider is used to swing the input voltage (+0.5V … +1.0V). The output frequency of the AD654 depends on the position of the slider.

Adjusting the frequency of the ceph head support

Use **service program Sr 14 FrE** to check the frequency of the pan head support.
The frequency can be adjusted with two trimmers (Trim1 and Trim2).
The frequency limits are 2100Hz and 4000Hz. The higher frequency (4000Hz +- 100Hz) must be adjusted **before** the lower frequency (2100Hz +- 100Hz).

N4200 Connectors

Connector J4201

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LAT-/PA	Lateral or PA image in cephalo
4	CEPHROK-	
5	CEPHCOK-	Ceph cassette sensor
6	CEPHLOK-	
7	CEPHMIDSW	Ceph movement sensor
8	CEPHLIMSW	Ceph movement sensor
9	CEPENA	Ceph stepper motor drive enable
10	CEPHDIR	Ceph stepper motor drive direction
11	-	Not used
12	CPPROJTRIG-	
13	FILT5	
14	CAECRFRQ	Ceph (nasion/head size) frequency
15	-	Not used
16	-	Not used
17	CEPHUP-	Z movement up
18	CEPHDOWN-	Z movement down
19	+5V	Power supply voltage
20	GND	Ground
21	CPOWER-	Ceph-CCD power active
22	CIMAGE-	Ceph-CCD image active
23	CEPHCLK	Ceph stepper motor clock
24	CDETCLK	CCD detector clock
25	CLASLIT	Enables head size measurement
26	GND	Ground

Connector J4202

Pin	Signal	Description
1	-	Jumper connection
2	-	Jumper connection

Connector J4203

Pin	Signal	Description
1	CEPHCOK-	Cephalo cassette sensor
2	GND	Ground

Connector J4204

Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	-	Not used
4	GND	Ground
5	-	Not used
6	GND	Ground

Connector J4205

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LAT-/PA	Lateral or PA image in cephalo
4	CEPHROK-	
5	CEPHCOK-	Cephalo cassette sensor
6	CEPHLOK-	
7	CEPHMIDSW	Ceph movement sensor
8	CEPHLIMSW	Ceph movement sensor
9	CEPENA	Ceph stepper motor drive enable
10	CEPHDIR	Ceph stepper motor drive direction
11	-	Not used
12	CPPROJTRIG-	
13	FILT5	Connected to +5v
14	CAECRFRQ	Ceph frequency
15	-	Not used
16	-	Not used
17	CEPHUP-	Z movement up
18	CEPHDOWN-	Z movement down
19	+5V	Power supply voltage
20	GND	Ground
21	CPOWER-	Ceph-CCD power active
22	CIMAGE-	Ceph-CCD image active
23	CEPHCLK	Cephalo stepper motor clock
24	CDETCLK	CCD detector clock
25	CLASLIT	Enables head size measurement
26	GND	Ground

Connector J4206

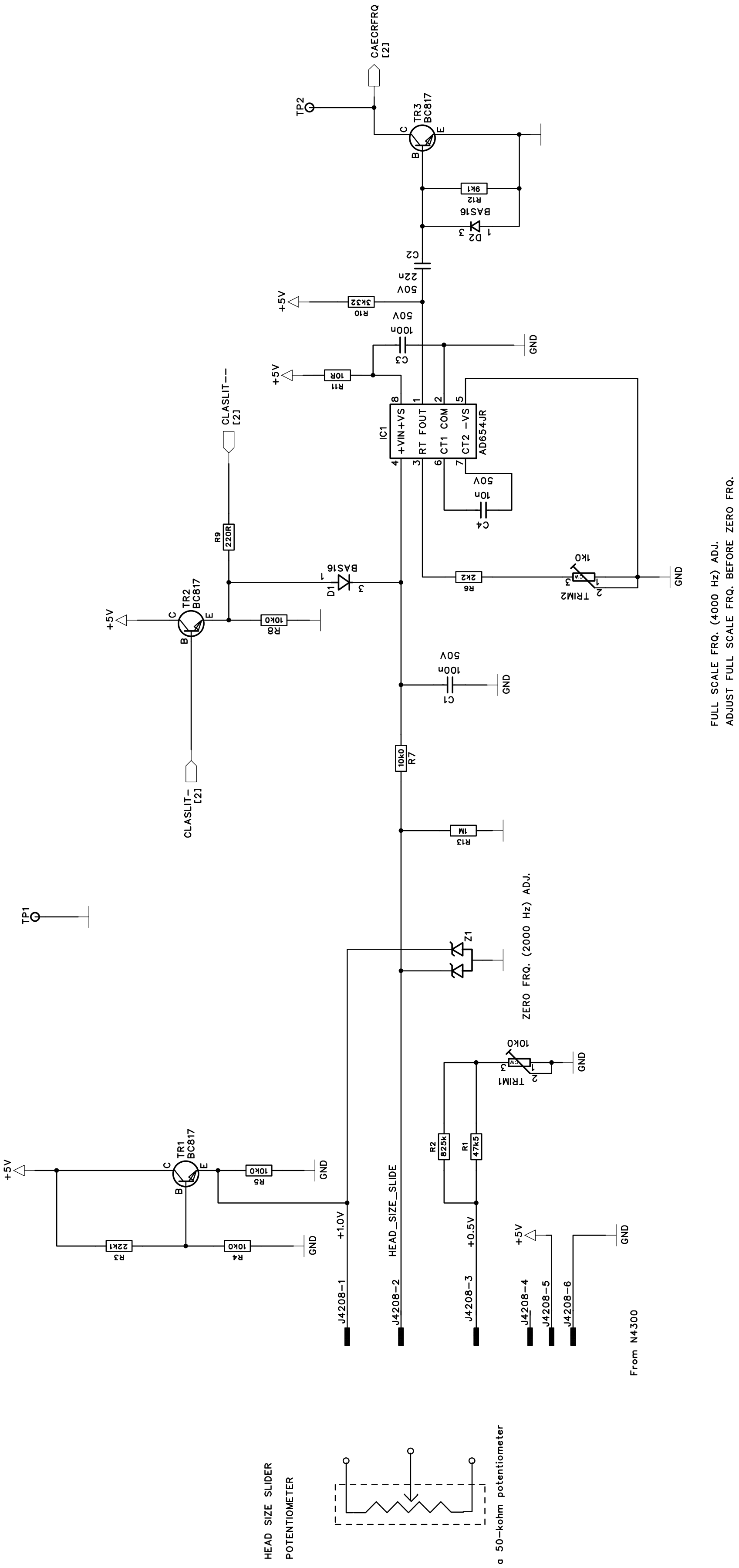
Pin	Signal	Description
1	GND	Ground
2	+34V	Power supply voltage
3	GND	Ground
4	+34V	Power supply voltage
5	ESTOP1_5V	Estop-voltage loop to/from ceph
6	ESTOP_5V	Estop-voltage loop to/from ceph
7	ZENA1-	Z movement enable1
8	-	Not used
9	-	Not used
10	-	Not used

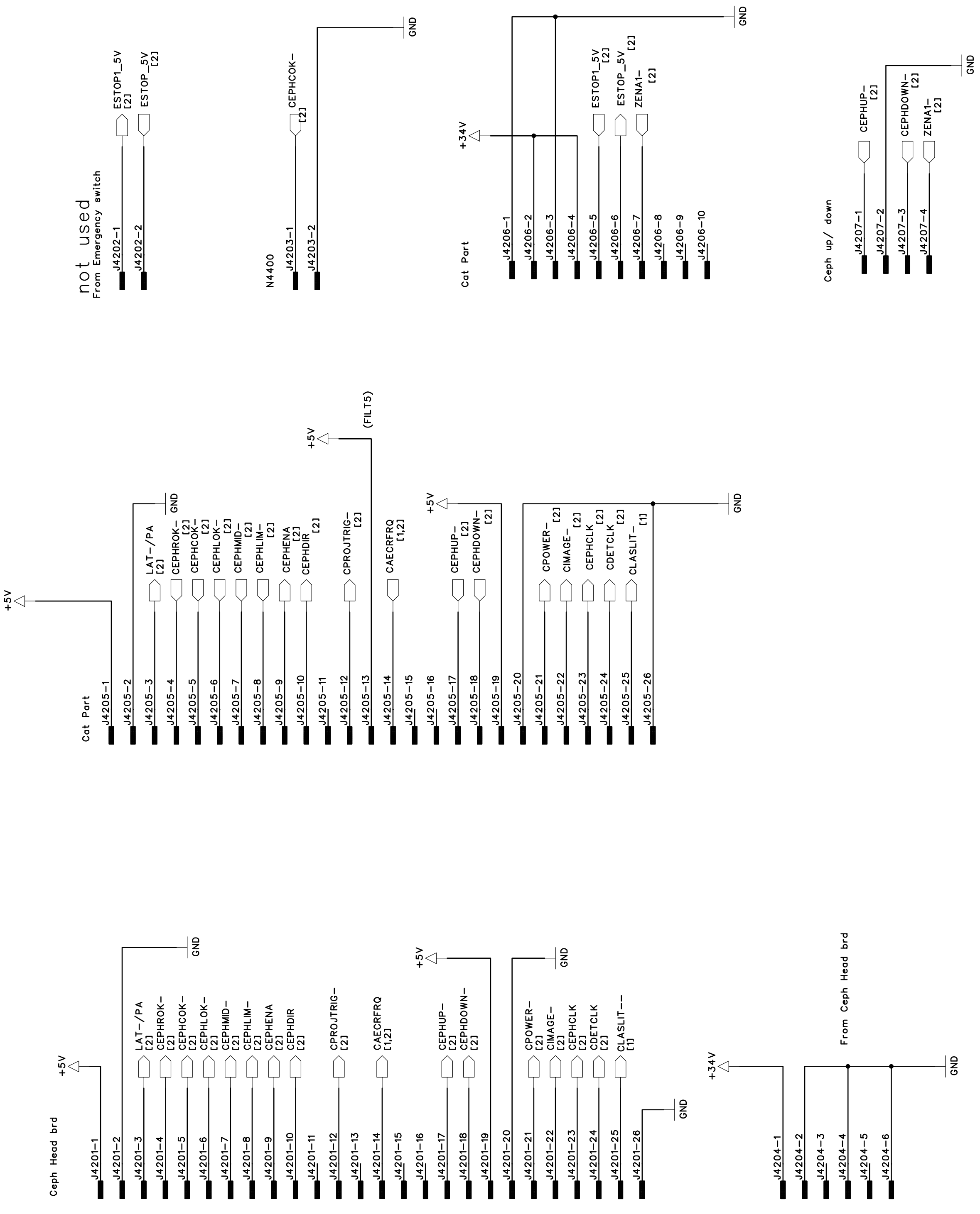
Connector J4207

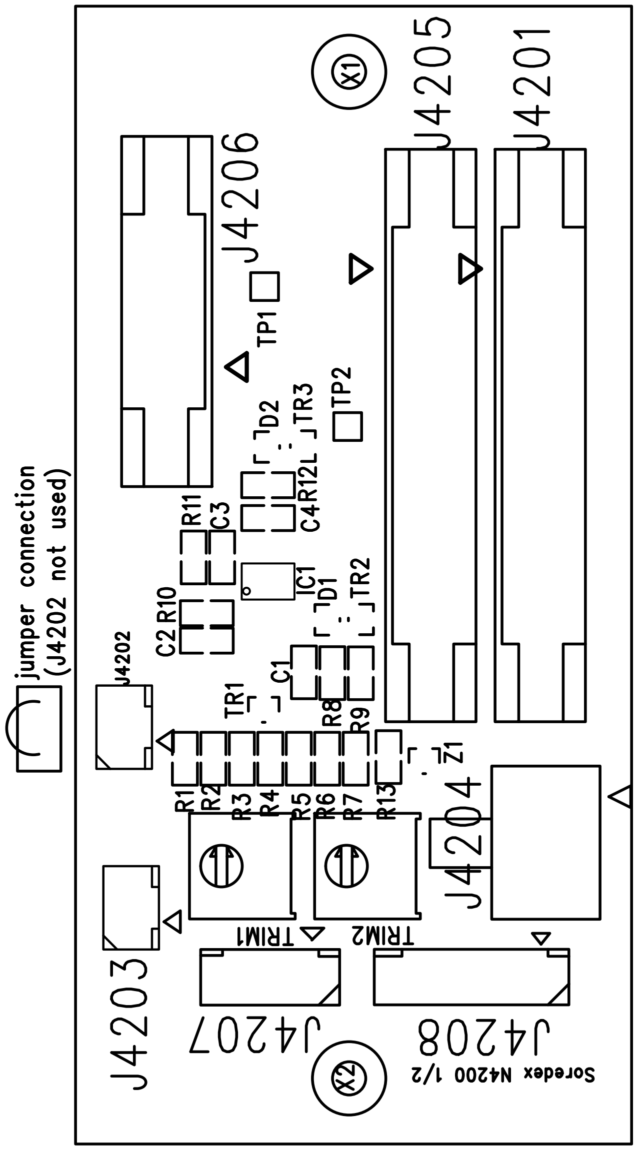
Pin	Signal	Description
1	CEPHUP-	Z movement up
2	GND	Ground
3	CEPHDOWN-	Z movement down
4	ZENA1-	Z movement enable1

Connector J4208

Pin	Signal	Description
1	+1V	
2	HEAD_SIDE_SLIDE	
3	+0.5V	
4	-	Not used
5	+5V	Power supply voltage
6	GND	Ground


CAECRFRQ [2]
TP2
TR3 BC817
R12 9k1
D2 BAS16
C2 22n 50V
R10 3k32
C3 100n 50V
R11 10R
IC1 AD654JR
+VIN +VS
RT FOUT
CT1 COM
CT2 -VS
C4 10n 50V
CLASLIT-- [2]
R9 220R
D1 BAS16
TR2 BC817
R8 10k0
R6 2k2
TRIM2 1k0
FULL SCALE FRQ. (4000 Hz) ADJ.
ADJUST FULL SCALE FRQ. BEFORE ZERO FRQ.
C1 100n 50V
R7 10k0
CLASLIT- [2]
R13 1M
TP1
Z1
ZERO FRQ. (2000 Hz) ADJ.
TRIM1 10k0
R2 825k
R1 47k5
TR1 BC817
R5 10k0
R3 22k1
R4 10k0
+1.0V
HEAD_SIZE_SLIDE
+0.5V
+5V
GND
J4208-1
J4208-2
J4208-3
J4208-4
J4208-5
J4208-6
From N4300
HEAD SIZE SLIDER POTENTIOMETER
a 50-kohm potentiometer




X1
J4205
J4201
J4206
TP1
TP2
D2
TR3
C4
R12
R11
C3
IC1
D1
TR2
C2
R10
jumper connection
(J4202 not used)
J4202
TR1
C1
R8
R9
Z1
R1
R2
R3
R4
R5
R6
R7
R13
J4204
TRIM1
TRIM2
J4203
J4207
J4208
Soredex N4200 1/2
X2

N4355 Ceph filter position board

N4355 Location

In Cranex D ceph head support.
To access, remove ceph head top cover and the head support from the ceph head and remove the head support lower cover.

N4355 Field replaceable parts

None.

N4355 Description

There are potentiometers on the board that measure the width of the patient's head and the position of nasion support. The "head size" voltage signal is fed to the N4200 board where it is converted into frequency and the nasion position signal is fed to the N5900 board where it is also converted into frequency. Both these frequency signals are utilized by the CPU to automatically set the kV (the "head size" frequency) and control the soft tissue filtering (the nasion position frequency adjusted using N4200).

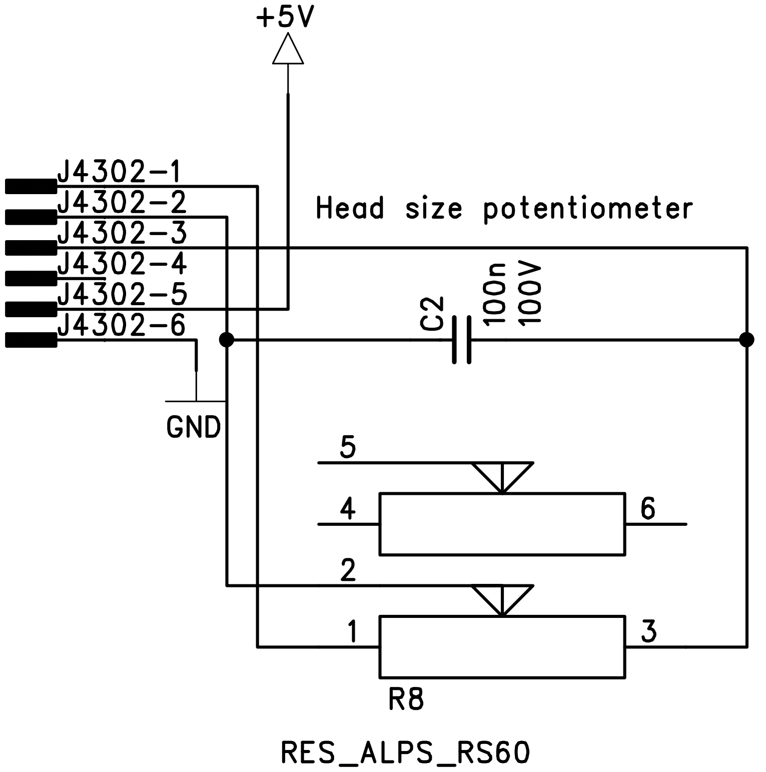
N4355 Connectors

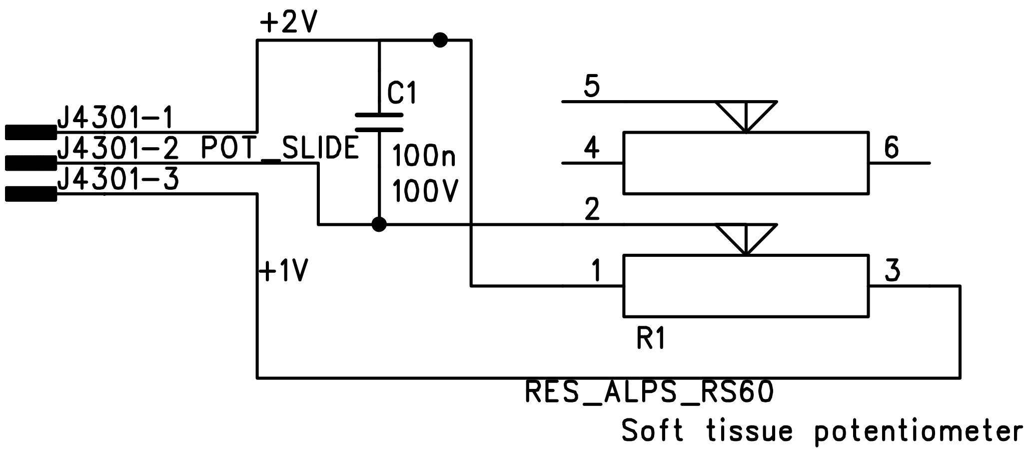
Connector J4301

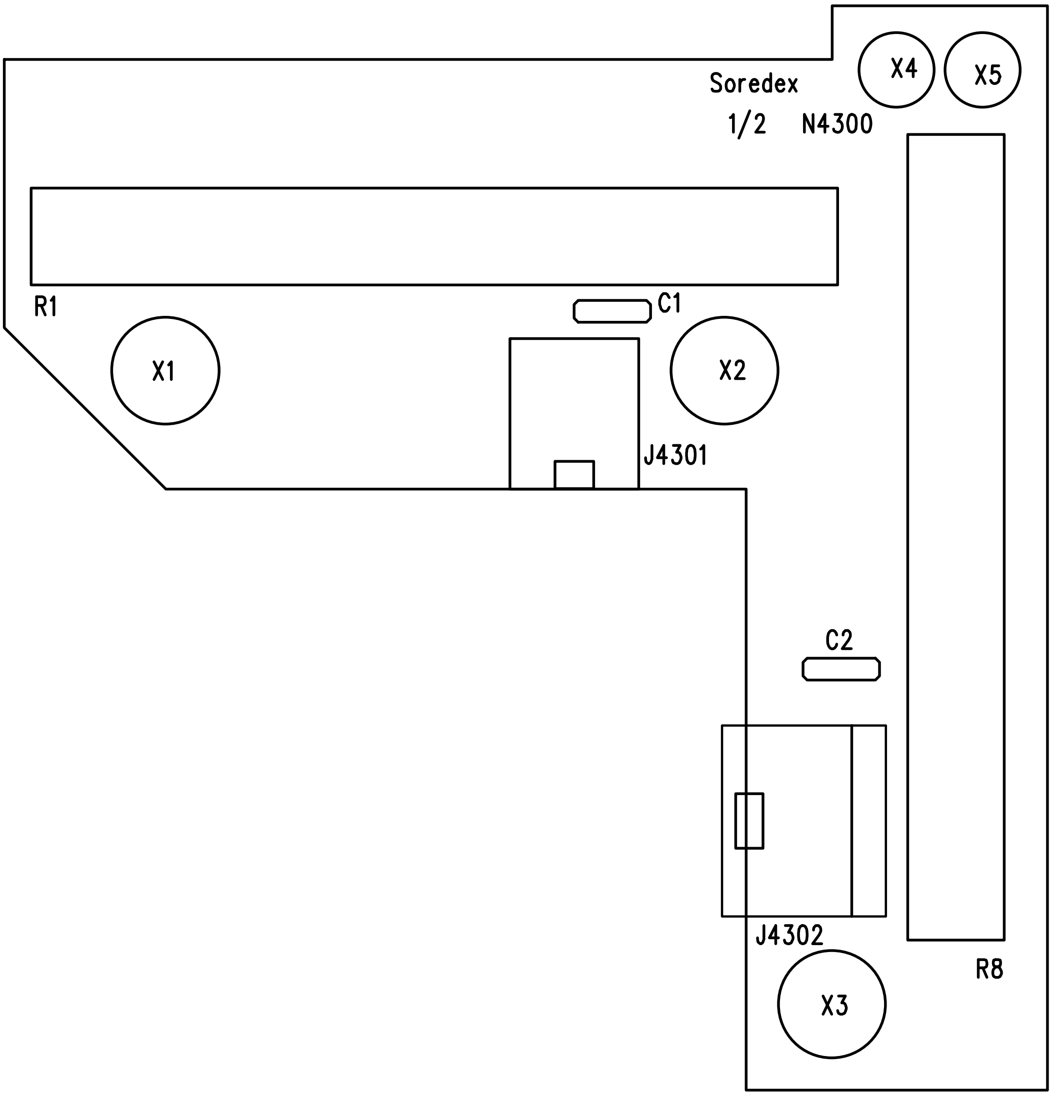
Pin	Signal	Description
1	+2V	
2	POT_SLIDE	
3	+1V	

Connector J4302

Pin	Signal	Description
1	+1V	
2	HEAD_SIDE_SLIDE	Head size dependant kV
3	+0.5V	
4	-	Not used
5	+5V	Power supply voltage
6	GND	Ground


+5V
J4302-1
J4302-2
J4302-3
J4302-4
J4302-5
J4302-6
Head size potentiometer
C2
100n
100V
GND
5
4
6
2
1
3
R8
RES_ALPS_RS60


+2V
C1
J4301-1
J4301-2 POT_SLIDE
J4301-3
100n
100V
+1V
5
4
6
2
1
3
R1
RES_ALPS_RS60
Soft tissue potentiometer


Soredex
1/2 N4300
X4
X5
R1
C1
X1
X2
J4301
C2
J4302
R8
X3

N4600 Y-layer Sensor

N4600 Location

In upper shelf.
To access, remove top covers

N4600 Field replaceable parts

None.

N4600 Description

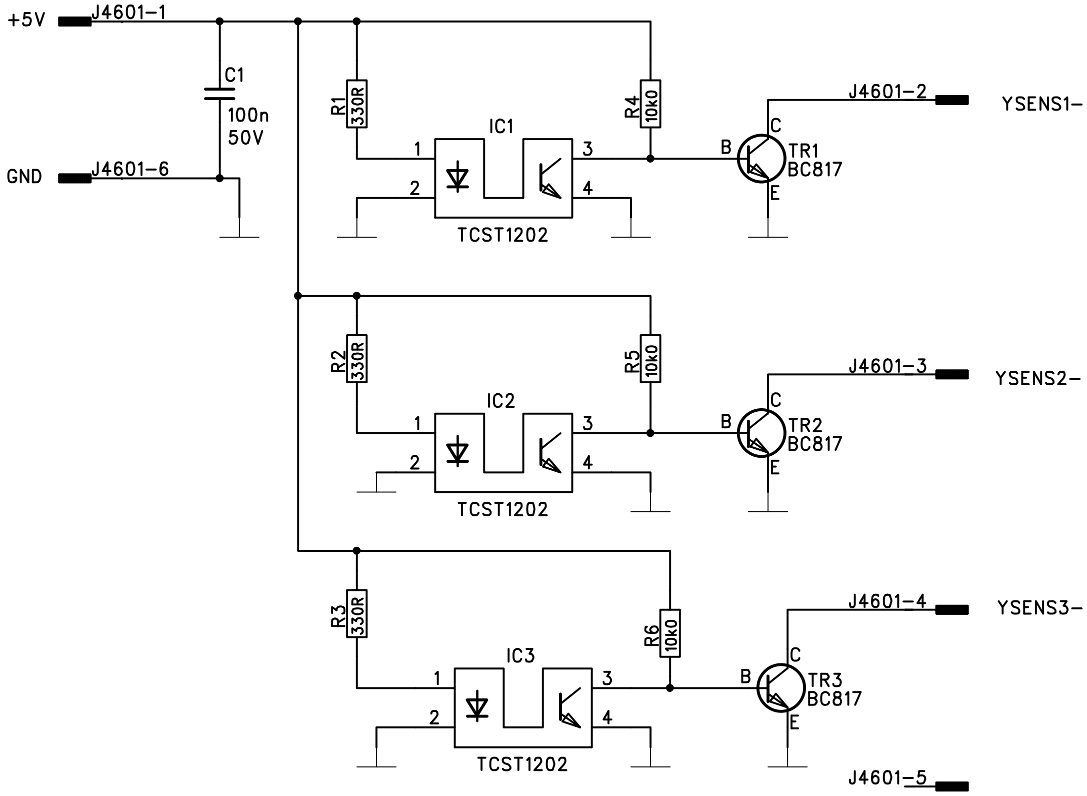
The N4600 board is used to detect linear movement positions. The board comprises three optical switches that generate sensor signals YSENS1*- YSENS2* according to the deteted position.
YSENS2 is connected to LINMIDSW and one of the signals YSENS1/YSENS3 is connected to LINLIMSW. These conections are selected with a jumper on the Top Rack board. L indicates left-hand ceph (when looking at the unit from the front) and R right-hand ceph.
The jumper must be in correct position for the appropriate ceph unit.

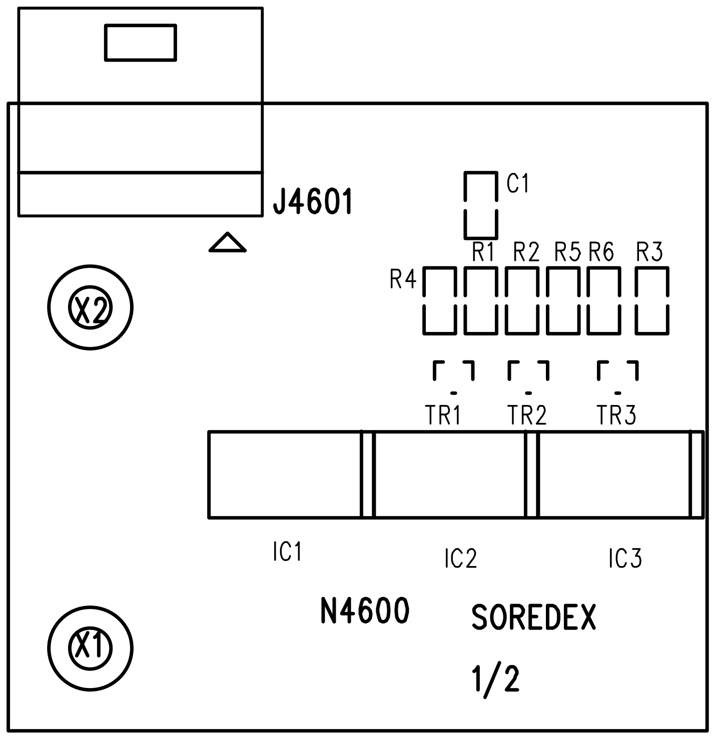
Each optosensor consists of two parts, a transmitter LED, and a receiver or base. The sensor signals remain on as long as the base receives light from the LED. If the light beam to the base is cut off, for example by the positioning rail, the sensor signal is switched off.

N4600 Connectors

Connector J4601

Pin	Signal	Description
1	+5V	Power supply voltage
2	YSENS1-	Linear movement sensor1
3	YSENS2-	Linear movement sensor2
4	YSENS3-	Linear movement sensor3
5	-	Not used
6	GND	Ground


+5V
J4601-1
C1
100n
50V
GND
J4601-6
R1
330R
R4
10k0
IC1
1
2
3
4
TCST1202
B
C
E
TR1
BC817
J4601-2
YSENS1-
R2
330R
R5
10k0
IC2
TCST1202
TR2
BC817
J4601-3
YSENS2-
R3
330R
R6
10k0
IC3
TCST1202
TR3
BC817
J4601-4
YSENS3-
J4601-5


J4601
C1
R1 R2 R5 R6 R3
R4
X2
TR1 TR2 TR3
IC1 IC2 IC3
N4600
SOREDEX
1/2
X1

N4700 Power Supply

N4700 Location

In upper shelf.
To access, remove top covers

N4700 Field replaceable parts

Fuses
F1 10AT/250 Vac (UL C/A, code 3600008)
F2 6.3AT/250 Vac (UL C/A, code 3600017)
F3 2AT/250 Vac (UL C/A, code 3600031)
All fuses are 6.3 mm x 32 mm.
WARNING
Always replace with the same type and rating of fuse.

N4700 Description

Power supply board provides rectified operating voltages of +310V, +34V, ±25V and also 12VAC (not used at present). The +310VDC has its own ground potential but all the other operating voltages are connected to a single ground potential. A jumper allows the main voltage for the board to be selected. If the jumper is connected to connector S2 the main voltage is 230V and if it is connected to S1 the main voltage 110V.
IMPORTANT NOTE
The main voltage CANNOT be converted to other mains voltage in the field because the z-motor must be of different type depending on the mains voltage.
Board has three fuses, 6.3A for +34V, 2A for ±25V and 10A for 12VAC. The 310VDC output is relay controlled.

N4700 Indicator LEDs

LED	Colour	Indicates
LA1	orange	primary voltage on
LA2	orange	+310Vdc on
H1	red	relay on for +310Vdc
H2	red	relay on for +310Vdc
H5	green	+34V on
H6	green	+25V on
H7	green	-25V on
H8	green	12Vac on

N4700 Test points

TP	Signal	Description
TP1	+310Vdc	
TP2	+155Vdc	
TP3	310V GND	
TP5	Primary voltage (110/230Vac)	
TP6	Primary voltage (110/230Vac)	
TP7	RG2 relay control (0-24Vdc)	
TP8	RG1 relay control (0-24Vdc)	
TP9	+34V	
TP10	+25V	
TP11	-25V	
TP12	12Vac	
TP13	GND	

N4700 Connectors

Connector X21

Pin	Signal	Description
1	110/230V	Power line voltage
2	110/230V	Power line voltage
3	-	Not used

Connector X22

Pin	Signal	Description
1	310Vdc	Power supply to inverter board and capacitors
2	155Vdc	Power supply to capacitors
3	310VGND	Ground for 310Vdc power supply

Connector X24

Pin	Signal		Description
1	110V-T1-1	110V	transformer primary 1-1
2	100V-T1-2	110V	transformer primary 1-2
3	110V-T1-3	110V	transformer primary 2-1
4	110V-T1-4	110V	transformer primary 2-2
5	110V-T2-1	110V	transformer primary 3-
6	110V-T2-2	110V	transformer primary 3-2
7	110V-T2-3	110V	transformer primary 4-1
8	110V-T2-4	110V	transformer primary 4-2

Connector X25

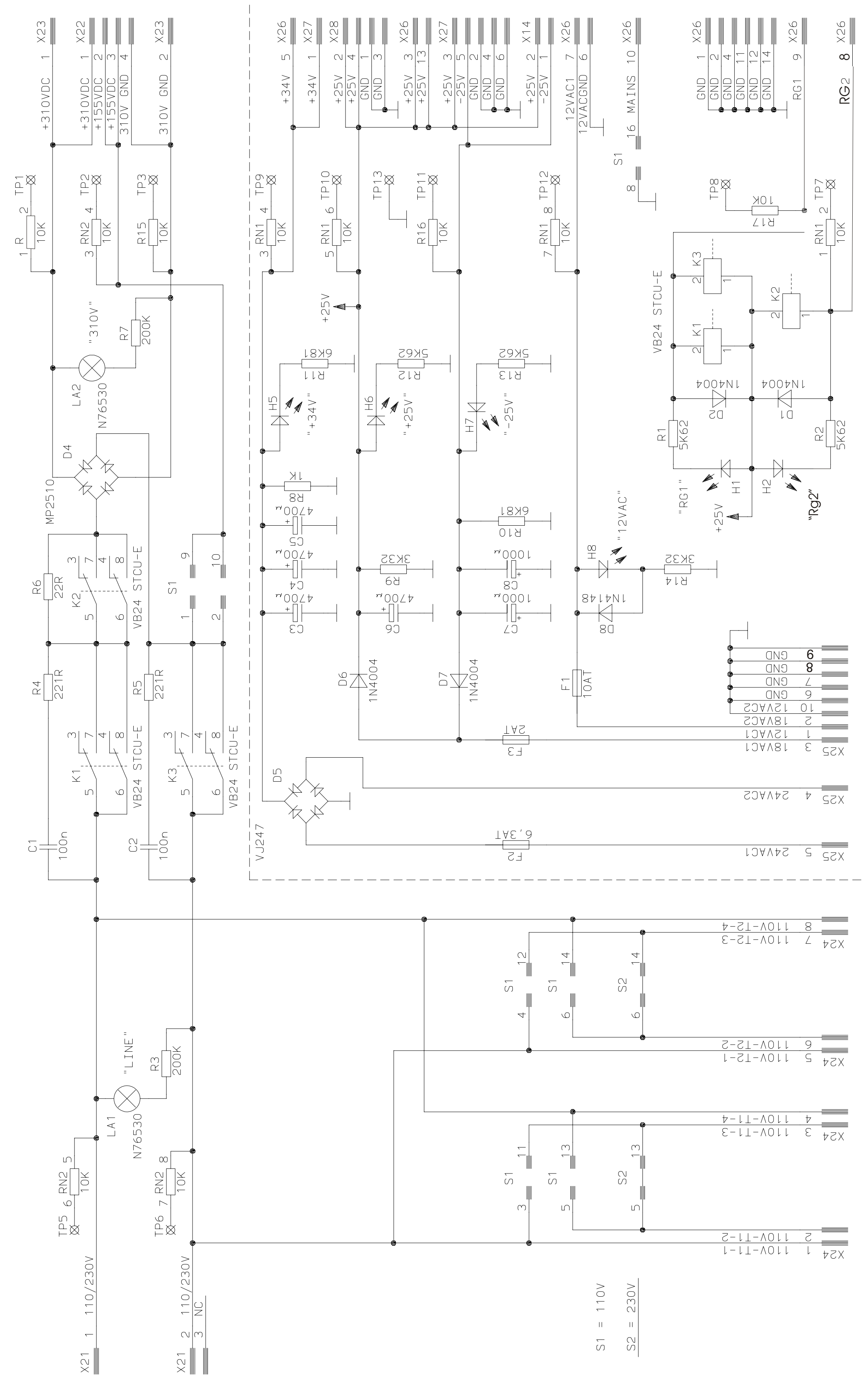
Pin	Signal	Description
1	12Vac1	12V transformer secondary 1-1
2	18Vac2	18V transformer secondary 2-2
3	18Vac1	18V transformer secondary 2-1
4	24Vac2	24V transformer secondary 3-2
5	24Vac1	24V transformer secondary 3-1
6-9	GND	Ground
10	12Vac2	12V transformer secondary 1-2

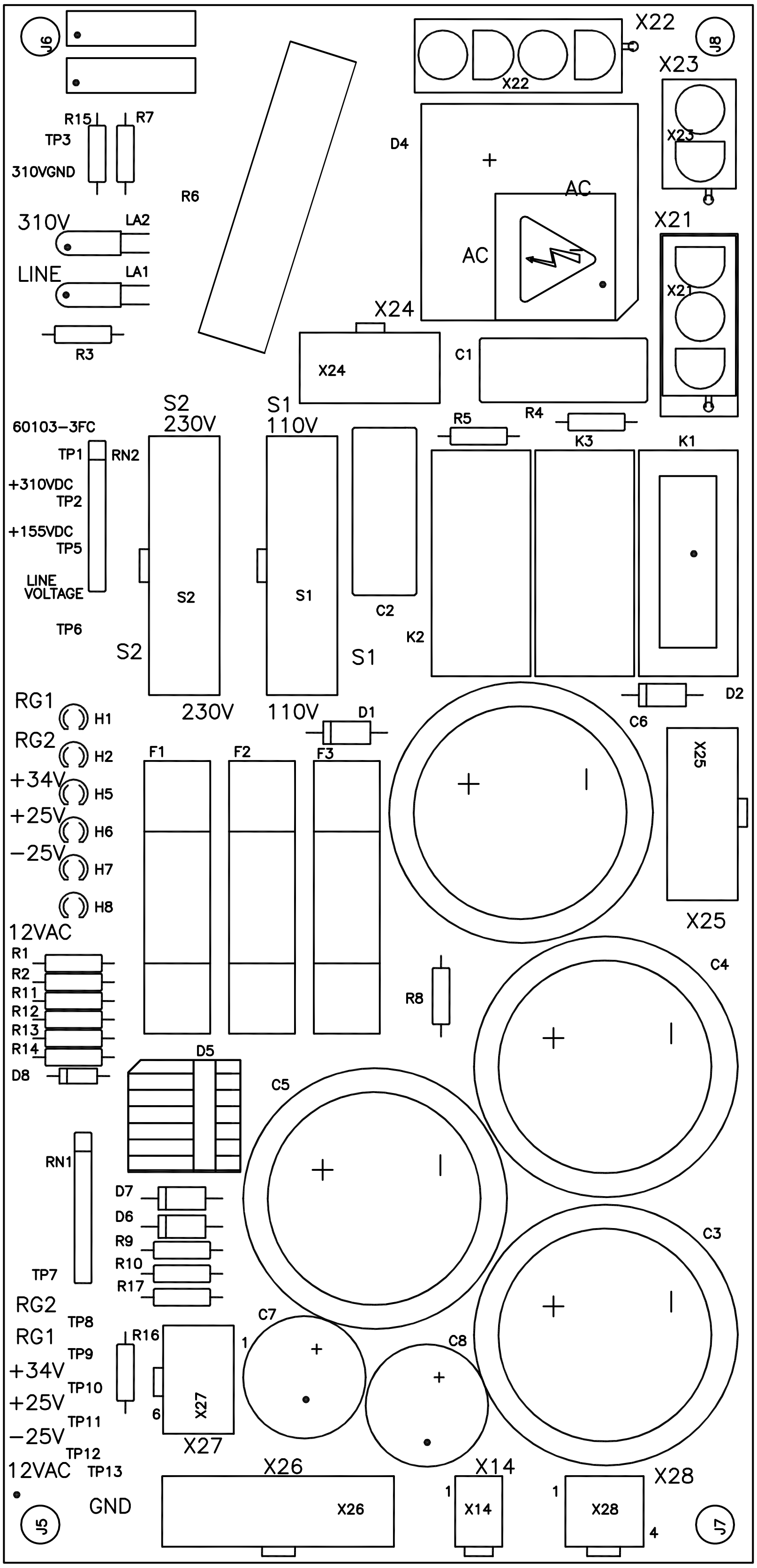
Connector X26

Pin	Signal	Description
1	GND	Ground
2	GND	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	+34V	Power supply voltage
6	-	Not used
7	-	Not used
8	RG2	310Vdc relay control
9	RG1	310Vdc relay control
10	Mains	110/230V information
11	GND	Ground
12	GND	Ground
13	+25V	Power supply voltage
14	GND	Ground

Connector X27

Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	-25V	Power supply voltage
6	GND	Ground




X22
X23
X21
X24
D4
AC
AC
C1
R15
R7
TP3
310VGND
R6
310V
LA2
LINE
LA1
R3
60103-3FC
S2 230V
S1 110V
R5
R4
K3
K1
TP1
RN2
+310VDC
TP2
+155VDC
TP5
LINE VOLTAGE
TP6
S2
S1
C2
K2
230V
110V
D1
D2
C6
RG1
H1
RG2
H2
+34V
H5
+25V
H6
-25V
H7
H8
F1
F2
F3
X25
12VAC
R1
R2
R11
R12
R13
R14
C4
R8
D8
D5
C5
RN1
D7
D6
R9
R10
R17
C3
TP7
RG2
TP8
RG1
TP9
+34V
TP10
+25V
TP11
-25V
TP12
12VAC
TP13
GND
R16
X27
C7
C8
X26
X14
X28
J5
J6
J7
J8

N5000 Optocoupler board

N5000 Location

In the z-carriage.
To access remove z-carriage front cover and z-carriage side cover, left.

N5000 Field replaceable parts

None.

N5000 Description

Optocoupler board isolates the accessible electronics of the panoramic unit from the PC and vice versa. It isolates all voltages inside the device from outside of the device. Isolated signals are serial port 1 and 2, signals (TxD and RxD) and exposure button signals. The board has its own floating power supply.

N5000 Connectors

Connector J5001

Pin	Signal	Description
1	TXD1	Serial interface 1 (transmit)
2	RXD1	Serial interface 1 (receive)
3	GND	Ground
4	TXD2	Serial interface 2 (transmit)
5	RXD2	Serial interface 2 (receive)
6	GND	Ground
7	EXPSW	Exposure
8	GND	Ground
9	+25V	Power supply voltage
10	GND	Ground

Connector J5002

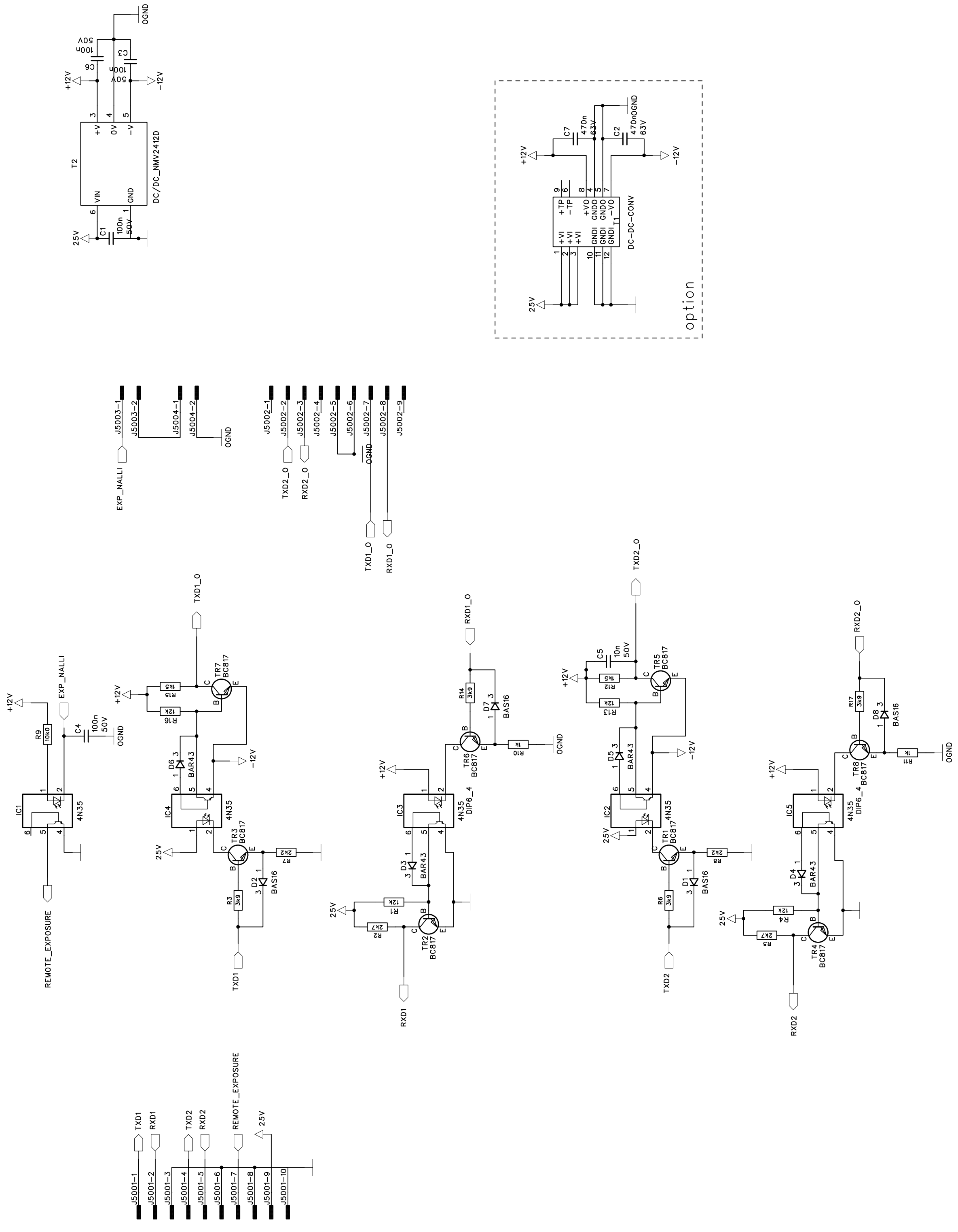
Pin	Signal	Description
1	-	Not used
2	TXD2_ISO	Isolation serial interface (transmit)
3	RXD2_ISO	Isolation serial interface (receive)
4	Not used	
5	GND_ISO	
6	GND_ISO	
7	TXD1_ISO	
8	RXD1_ISO	
9	-	Not used

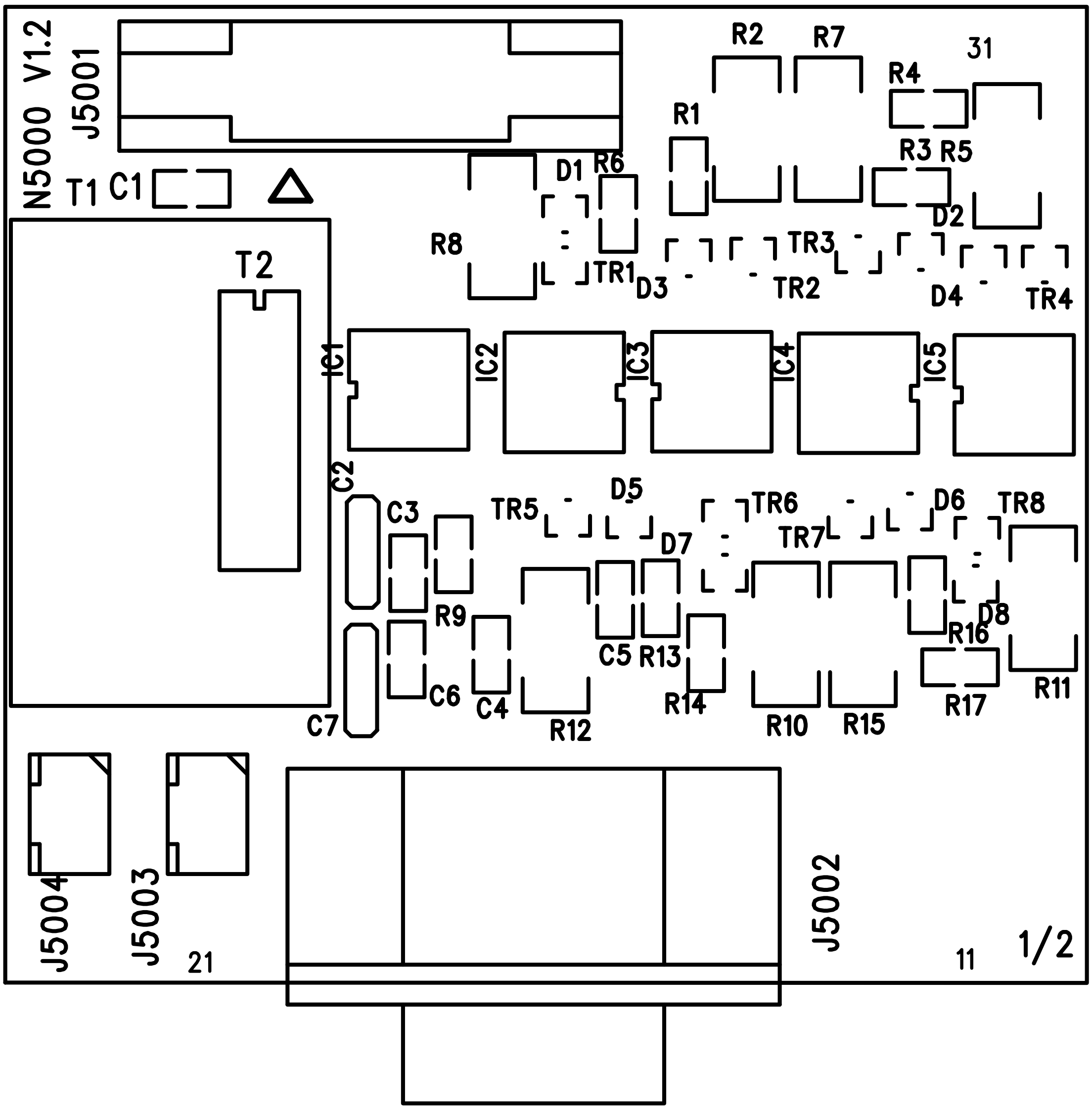
Connector J5003

Pin	Signal	Description
1	EXPSW-_ISO	
2	EXPSW1	Exposure

Connector J5004

Pin	Signal	Description
1	EXPSW-_ISO	
2	GND_ISO	




N5000 V1.2
J5001
T1
C1
T2
R1
R2
R7
R4
31
R3 R5
R6
D1
R8
TR1
D3
TR3
TR2
D2
D4
TR4
IC1
IC2
IC3
IC4
IC5
C2
C3
TR5
D5
TR6
D6
TR8
D7
TR7
R9
C5
R13
R16
D8
C6
C4
R14
R17
R11
C7
R12
R10
R15
J5004
J5003
21
J5002
11
1/2

N5100/5101 Core Module

N5100 - unit versions with s/n **B81642 and earlier**.
N5101 - unit versions with s/n **B91643 and later**.
IMPORTANT NOTE:
Core module is the same but the S/W on N5100 and N5101 is NOT interchangeable.

N5100/5101 Location

Attached to the IO board, in the z-carriage.
To access, remove z-carriage front cover

N5100/5101 Field replaceable parts

None

N5100/5101 Description

The Core Module is the main controller of the unit. It comprises an Infineon C167CR-LM microcontroller (16-bit), Flash-, SRAM- and EEPROM memories and an I/O interface (CAN, UART, SPI). The unit software is stored on the Flash-memory. The user settings are stored on the EEPROM.
There is a 10-bit on-chip A/D converter on the microcontroller. This is not used.
When the reset button S1 is pressed, LED H2 will come on briefly. In the normal operation mode only LED H1 will come on.
Low-Dropout Voltage Regulator (ICA1) regulates the +5V supply voltage from the incoming higher input voltage.
This circuit board module is connected, via connector X902, to the digital I/O board (N5200).

Updating the software

Software can be updated by downloading it through the RS-connection or fibre optic cable. It is not necessary to change the Core Module to update the software.

Changing the Core Module

Before replacing the Core Module make a note of the preheat level of the existing tube. The existing preheat level can be found via the service mode (Sr 13 Prh).

Use this preheat level with the new Core Module. The preheat level can be entered via the service mode (Sr 13 Prh) into the new Core Module
If you replace a faulty Core Module run the preheat program (Sr 13 Prh) to reset the preheat value.

N5100/5101 Switches/Jumpers

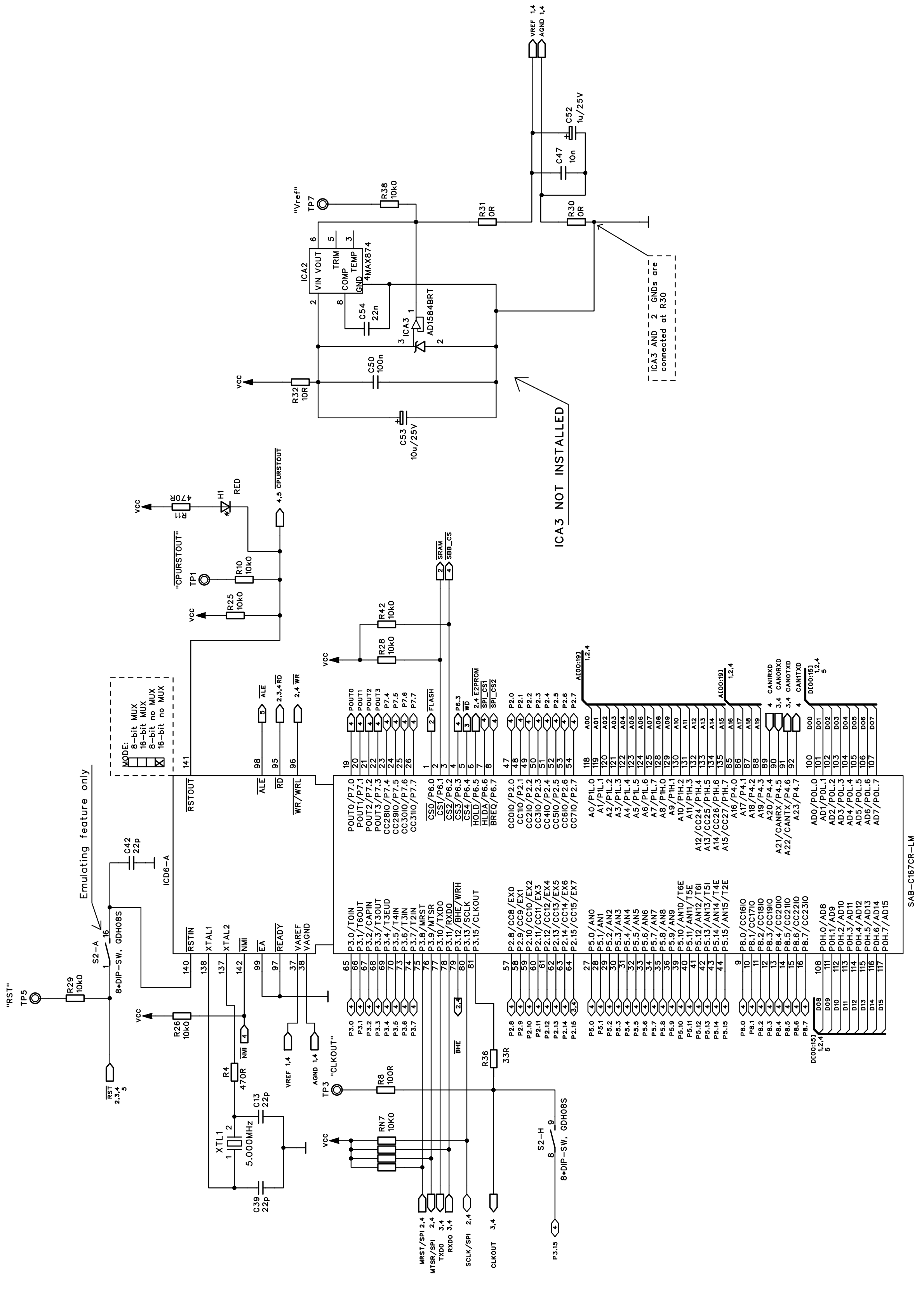
S1	Reset button	
S2	1	ON
	2	ON
	3	ON
	4	ON
	5	OFF
	6	OFF
	7	OFF
	8	OFF

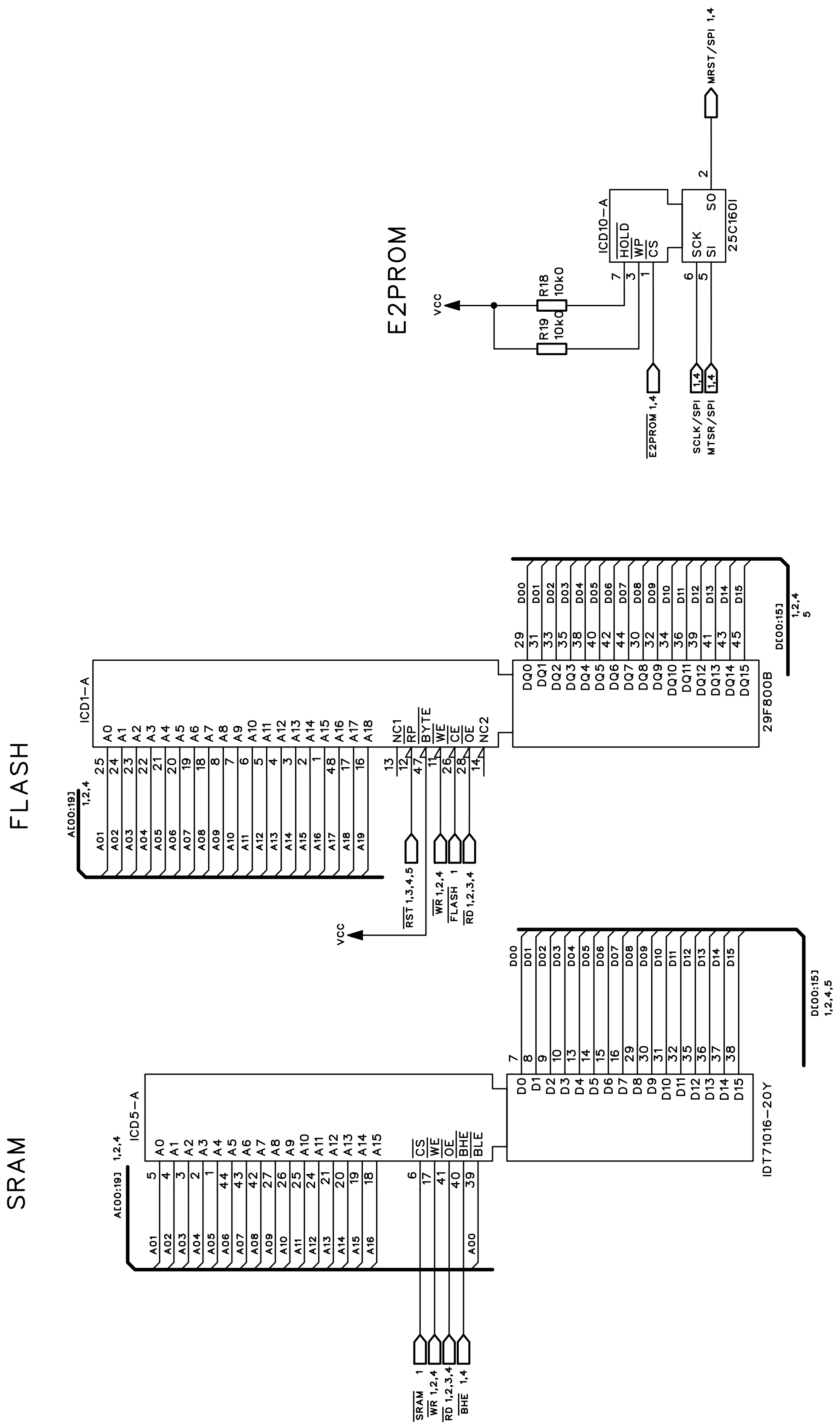
N5100/5101 Indicator leds

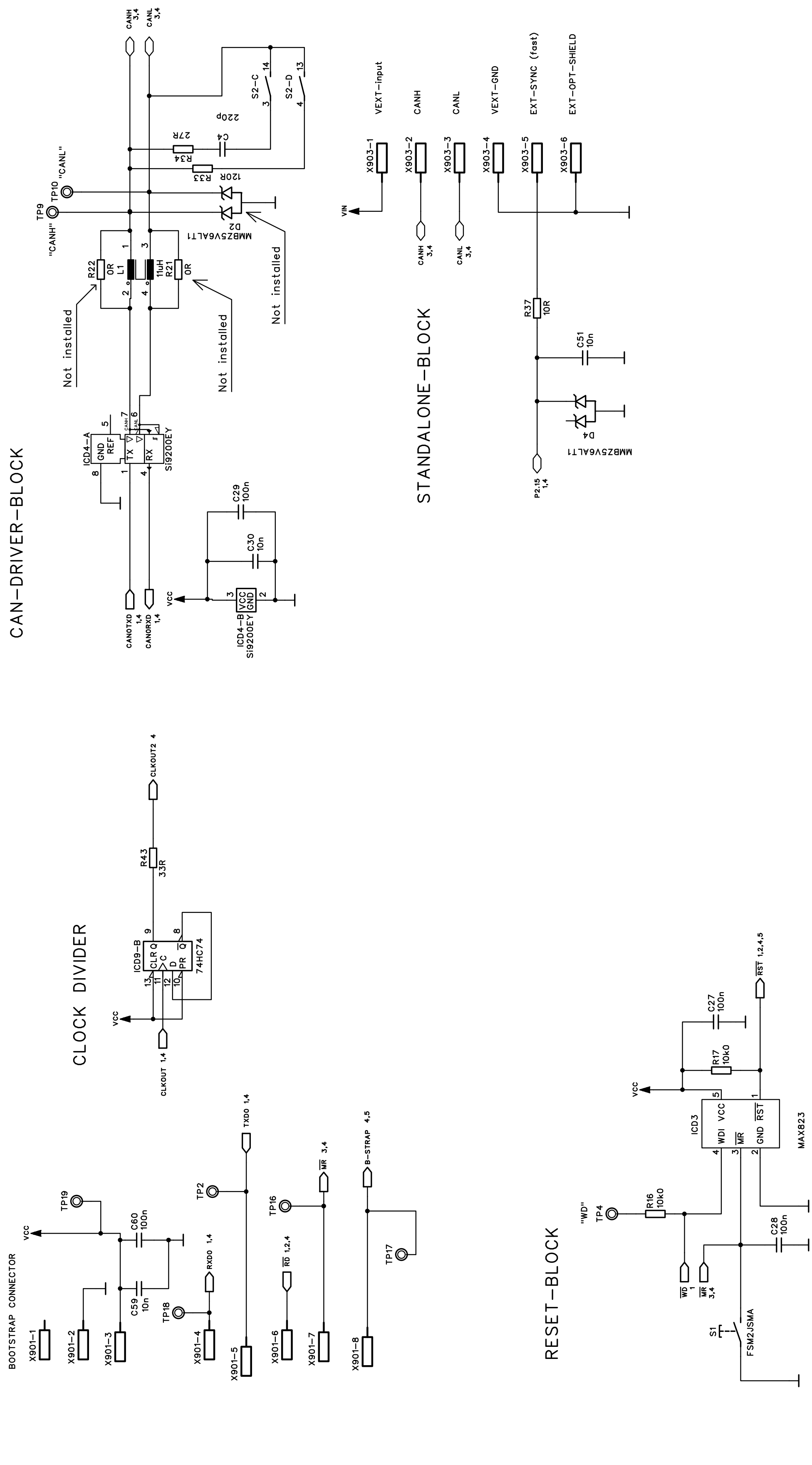
Led	Colour	Indicates
H1	Red	CPURSTOUT-
H2	Green	POWER ON

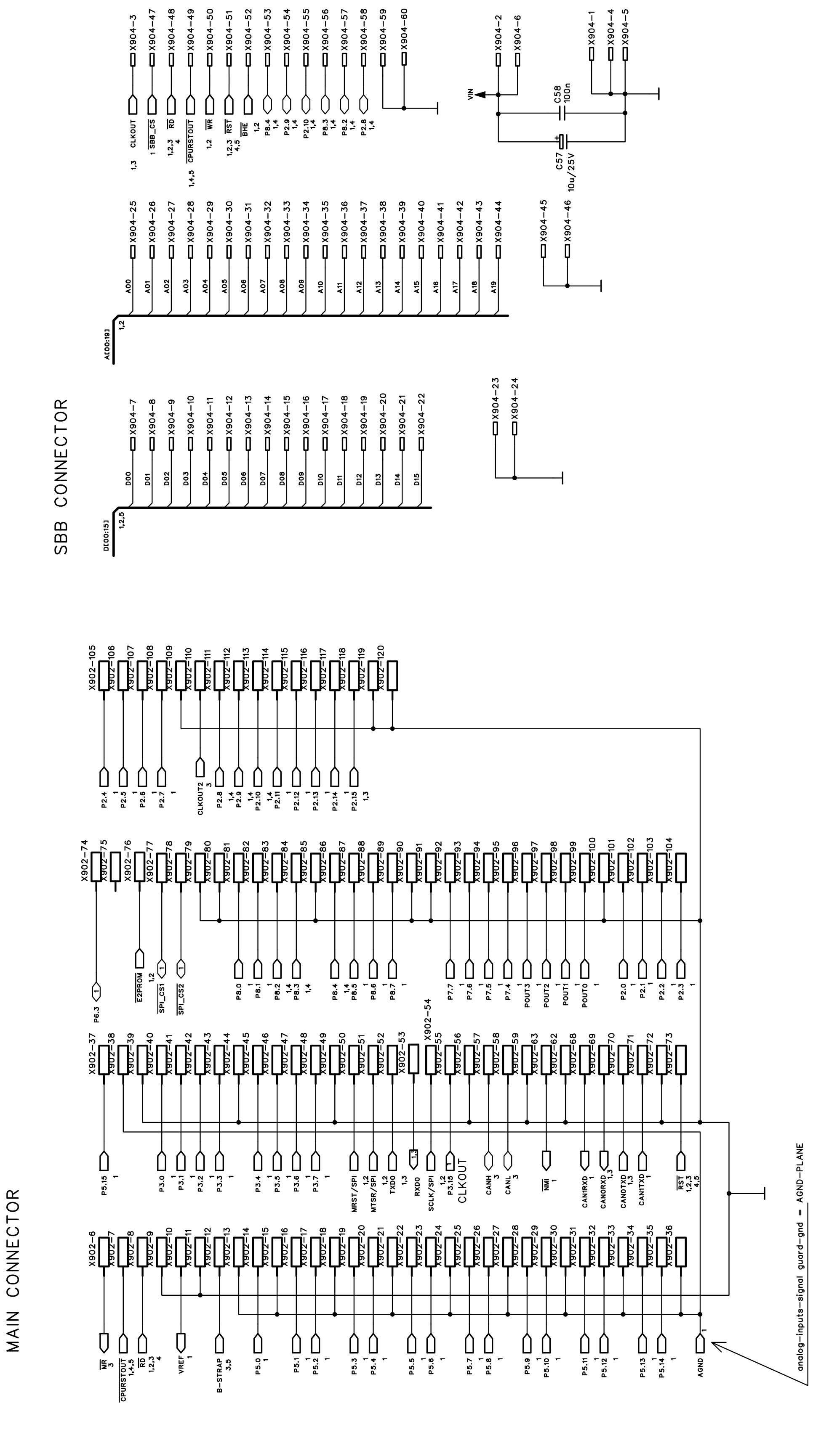
N5100/5101 Test points

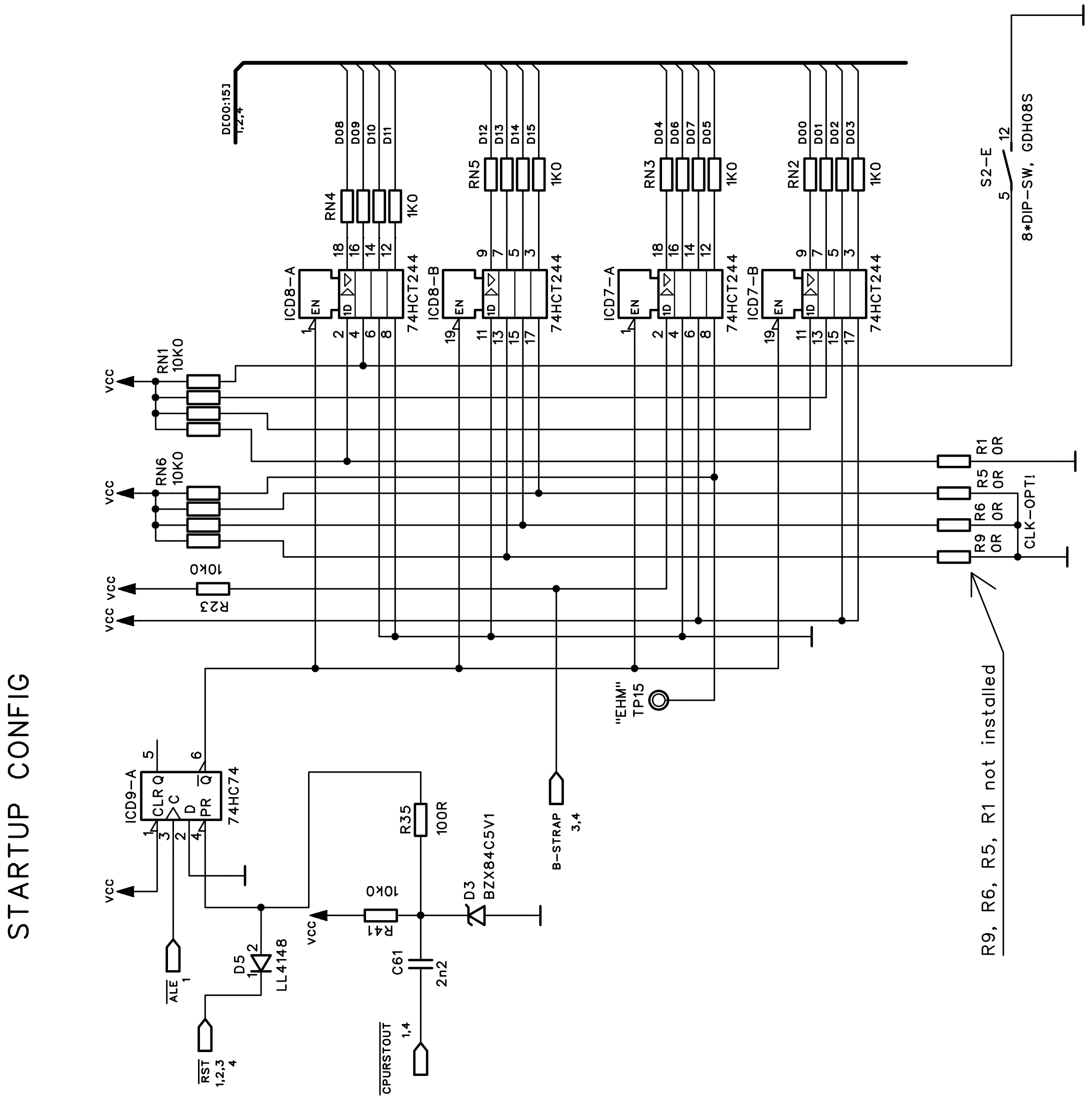
TP	Signal	Description
TP1	CPURSTOUT-	Reset out from the CPU
TP3	CLKOUT-	Clock out from the CPU
TP4	WD	Watchdog input
TP5	RST-	Reset
TP7	Vref	Ref voltage for CPU's A/D
TP9	CANH	Can Bus Signal
TP10	CANL	Can Bus Signal
TP11	Vin	Input voltage
TP12	GND	-
TP13	VCC	+5V supply voltage
TP14	GND	-
TP15	EHM	

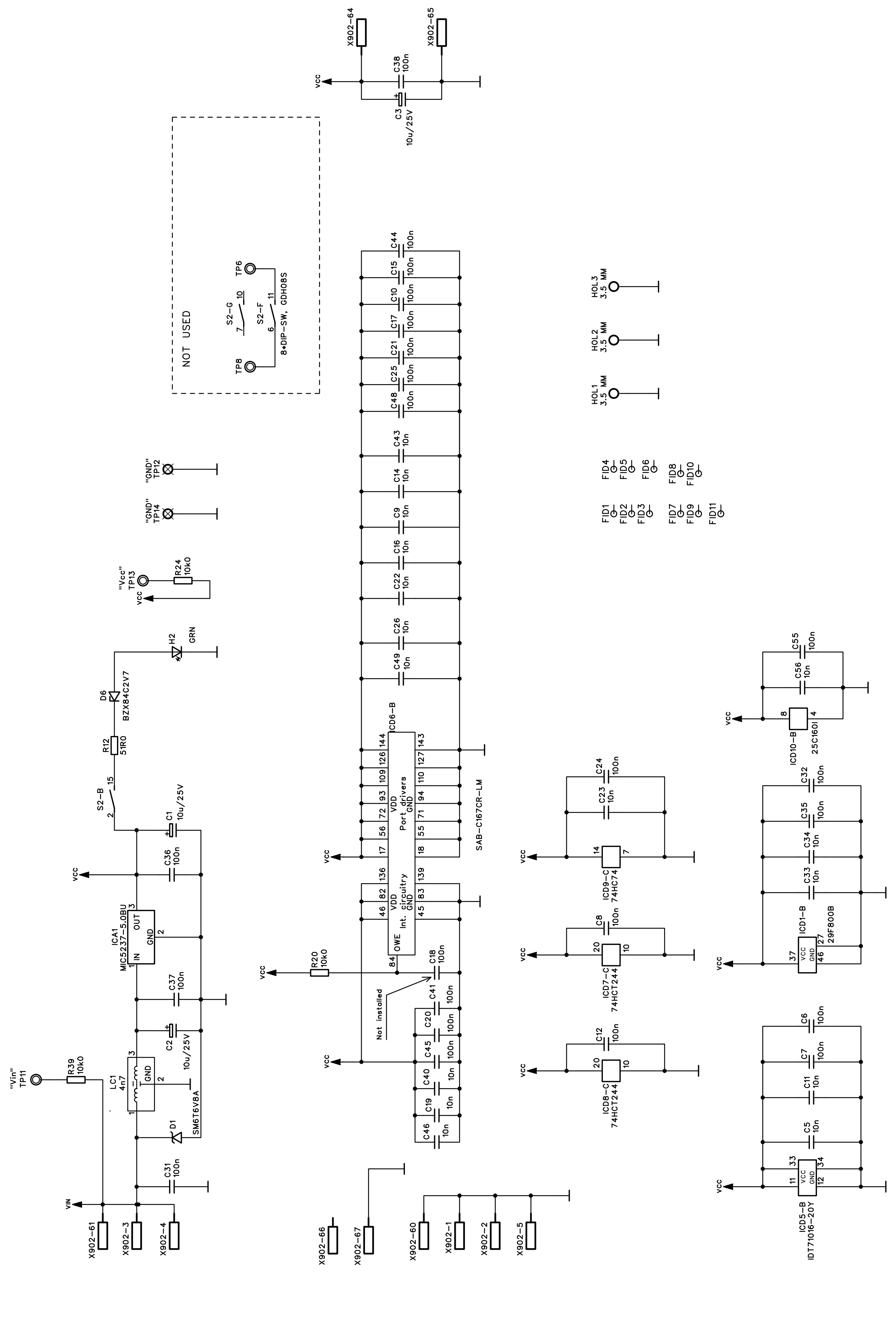

ICA3 NOT INSTALLED
ICA3 AND 2 GNDs are connected at R30
Emulating feature only
SAB-C167CR-LM

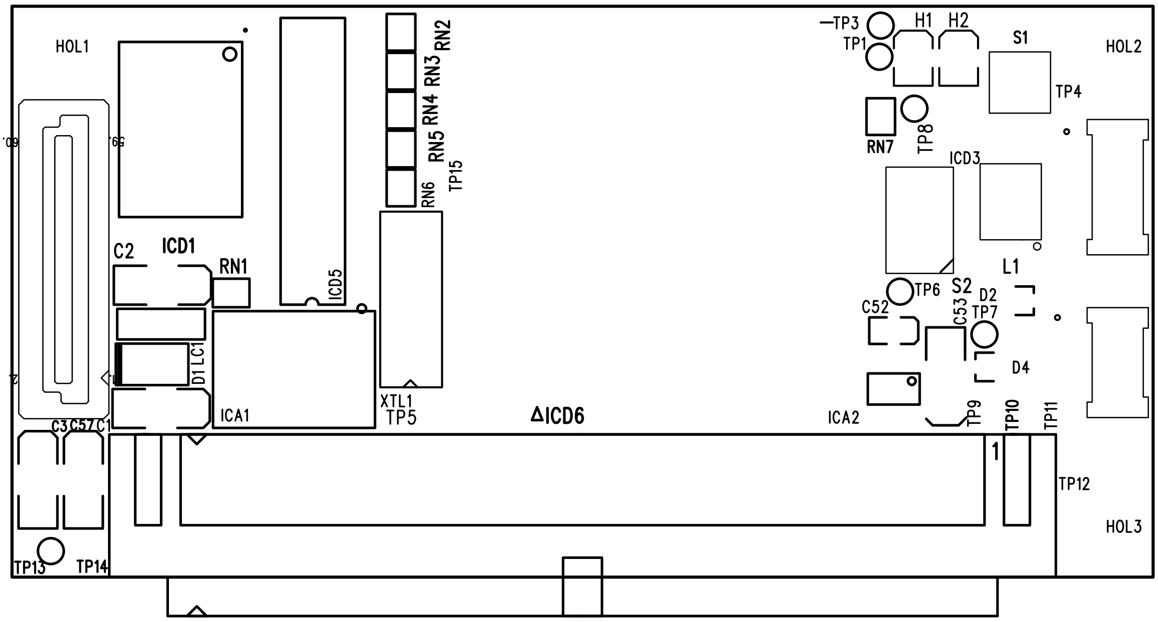

E2PROM
ICD10-A
25C160I
R18 10kΩ
R19 10kΩ
VCC
MRST/SPI 1,4
SCLK/SPI 1,4
MTSR/SPI 1,4
FLASH
ICD1-A
29F800B
A[00:19] 1,2,4
D[00:15] 1,2,4 5
RST 1,3,4,5
WR 1,2,4
FLASH 1
RD 1,2,3,4
SRAM
ICD5-A
IDT71016-20Y
D[00:15] 1,2,4,5
SRAM 1
BHE 1,4


CAN-DRIVER-BLOCK
STANDALONE-BLOCK
CLOCK DIVIDER
BOOTSTRAP CONNECTOR
RESET-BLOCK

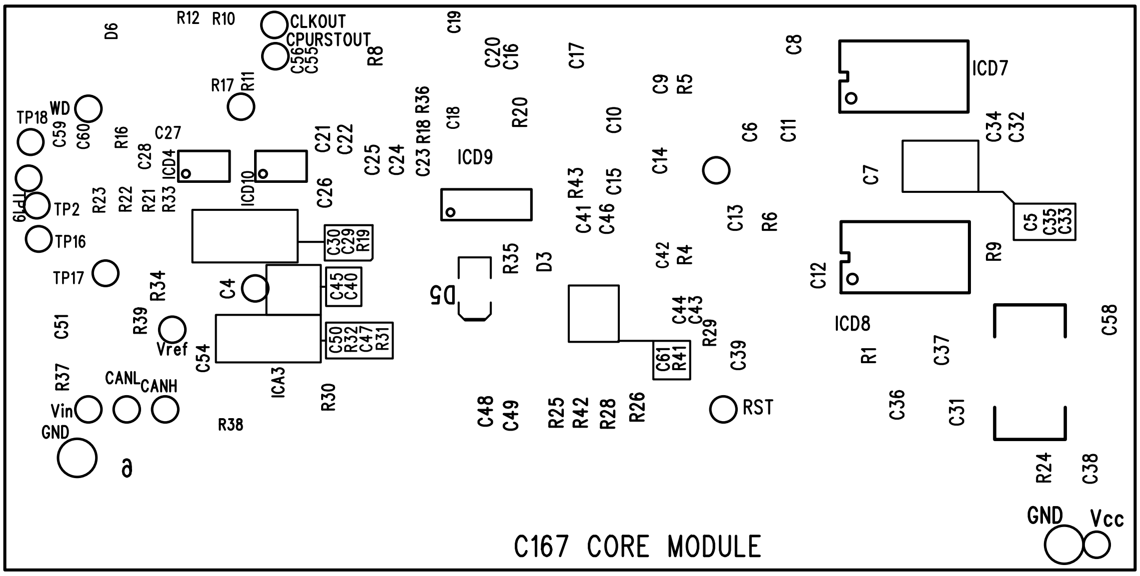

SBB CONNECTOR
MAIN CONNECTOR
analog-inputs-signal guard-gnd = AGND-PLANE


STARTUP CONFIG
R9, R6, R5, R1 not installed





S2 settings:
1-4 ON, 5-8 OFF


C167 CORE MODULE
CLKOUT
CPURSTOUT
WD
TP18
TP2
TP16
TP17
Vref
CANL
CANH
Vin
GND
RST
GND
Vcc
ICD4
ICD10
ICD9
ICA3
ICD7
ICD8
D5
D3
D6

N5200 Digital I/O board

N5200 Location

In the z-carriage.
To access, remove z-carriage front cover

N5200 Field replaceable parts

None

N5200 Description

The digital I/O board works as an interface between the core module (main controller) and the “outside world”. There are a large number of 74HC245 buffers to drive various signals. Some of the I/O signals are also optoisolated. The TTL/RS-232 conversion circuit (ICD33) is needed for the connection to the PC.

N5200 Switch

S1	1	ON
	2	OFF
	3	OFF
	4	OFF
	5	OFF
	6	OFF
	7	OFF
	8	ON

N5200 Jumpers

B - s/n B81642 and earlier

JP1	pin 2 and 3
JP2	pin 2 and 3
JP3	-

A - s/n B91643 and later

JP1	pin 1 and 2
JP2	pin 1 and 2
JP3	pin 2 and 3
JP1	pin 3 and JP2 pin 3

X 11 Normal and exhibition use

When the jumper is connected to "OFF-OPTION" pins the unit operates normally and x-rays are generated, factory setting.
When the jumper is connected to the "ON-OPTION" pins the unit operates normally but NO x-rays are generated.
This feature can be used, for example, to demonstrate the unit in exhibitions.

X 13	-
X 14	Program options
X 15 / L	Cephalostat on left side
X 15 / R	Cephalostat on right side

N5200 Indicator leds

Led	Colour	Indicates
H1	green	+25V
H2	green	+5V
H3	green	+6V
H4	green	TXD1 - COM 1
H5	green	TXD2 - COM 2

N5200 Test points

TP	Signal	Description
TP1	LINDIR	Direction of y-layer movement
TP2	LINENA	Enable of y-layer movement
TP3	CASDIR	Direction of collimator movement
TP4	CASENA	Enable of collimator movement
TP5	PREHREL	
TP6	PREH	
TP7	ROTENA	Enable of rotation movement
TP8	ROTDIR	Direction of rotation movement
TP9	XENA	
TP10	XDIR	
TP11	LINCLK	Clock signal of y-layer movement
TP12	CAS/DETCLK	Clock signal of collimator/CCD detector clock
TP13	ROTCLK	Clock signal of rotation movement
TP14	ZENA	Z-movement enable signal
TP15	ZDIR	Z-movement direction signal
TP16	RACKENA	-
TP17	RACKDIR	-
TP18	GND	-
TP19	GND1	-
TP20	+5V	-
TP21	+25V	-
TP22	CEPHCLK	Clock signal of ceph CCD movement
TP23	OUT5	
TP24	PROJLIT	
TP25	OUT4	
TP26	LASLIT	

TP27	GND1	
TP28	AECFRQ	frequency (head size)
TP29	MAFRQ	mA-frequency
TP30	GND1	
TP31	+6V	
TP32	CANL	CAN-bus signal
TP33	CANH	CAN-bus signal
TP34	EXPENA	Exposure enable
TP35	RG2	310V relay control
TP36	RG1	310V relay control
TP37	GND1	
TP38	SYSTEM_CLK_OUTPUT	
TP39	SYSTEM_CLK_OUTPUT/2	
TP40	RXD0	Receive data
TP41	RXD2	Receive data from terminal board
TP42	TXD2	Transmit data to terminal board

N5200 Connectors

Connector X1

Pin	Signal	Description
1	PNLCLK	Control panel clock
2	PNLOUT	Control panel data out
3	PNLA0	Control panel enable
4	Not used	
5	PNLIN	Control panel data in
6	-	Not used
7	GND	Ground
8	GND	Ground
9	WARNLIGHT	Exposure warning light
10	GND	Ground
11	GND	Ground
12	GND	Ground
13	+25V	Power supply voltage
14	+25V	Power supply voltage

Connector X2

Pin	Signal	Description
1	+25V	Power supply voltage
2	GND	Ground
3	GND	Ground
4	RG2	310Vdc relay control
5	RG1	310Vdc relay control
6	MAINS	110/230V information

Connector X3

Pin	Signal	Description
1	TXD1	
2	RXD1	
3	GND	Ground
4	TXD2	
5	RXD2	
6	GND	Ground
7	EXPSW	Exposure
8	GND	Ground
9	+25V	Power supply voltage
10	GND	Ground

Connector X4

Pin	Signal	Description
1	kVmA7	Digital kV and mA references
2	kVmA6	Digital kV and mA references
3	kVmA5	Digital kV and mA references
4	kVmA4	Digital kV and mA references
5	kVmA3	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA1	Digital kV and mA references
8	kVmA0	Digital kV and mA references
9	Prehrel	Preheat relay control
10	Preh	Preheat control
11	Expena	Exposure enable
12	kVmAsel	Select kV or mA
13	kVmAclk	Clock
14	Tempfail	Temperature too high
15	kVok	KV control is ok
16	mAok	MA control is ok
17	-	Not used
18	SOLOK-	
19	MIRROR-	Patient mirror closed
20	-	Not used
21	mAfrq	current to frequency information
22	GND	Ground
23	GND	Ground
24	Tubefail	Failure in tube head
25	GND	Ground
26	GND	Ground

Connector X5

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LINDIR	Linear movement direction
4	LINENA	Linear movement enable
5	CASDIR	Collimator movement direction
6	CASENA	Collimator movement enable
7	ROTENA	Rotation movement enable
8	ROTDIR	Rotation movement direction
9	-	Not used
10	-	Not used
11	LINCLK	Linear movement clock
12	CASCLK	Collimator movement clock
13	ROTCLK	Rotation movement clock
14	ZENA	Z movement enable
15	ZDIR	Z movement direction
16	-	Not used
17	-	Not used
18	PROJLIT	Patient position light enable
19	WARNLIGHT	Exposure warning light
20	XRAYLIT	Exposure warning light
21	Not used	
22	OUT4	Not used
23	OUT5	Not used
24	ZENA1-	Z movement enable1
25	GND	Ground
26	GND	Ground

Connector X6

Pin	Signal	Description
1	PANCASSW	Collimator position sensor
2	GND	Ground
3		
4	GND	Ground
5		
6		
7		
8	GND	Ground
9		
10	GND	Ground
11		
12	GND	Ground
13		

14	GND	Ground
15		
16		
17		
18	SOLENA	Solenoid enable
19	KV_FRQ_ENA	
20		

Connector X7

Pin	Signal	Description
1	+5V	Power supply voltage
2	-	Not used
3	-	Not used
4	-	Not used
5	YFORW	Linear movement forward
6	ZENA1-	Z movement enable1
7	YBACK	Linear movement back
8	-	Not used
9	RETURN	Return
10	GND	Ground
11	-	Not used
12	-	Not used
13	-	Not used
14	ZUP	Z movement up
15	-	Not used
16	-	Not used
17	ZDOWN	Z movement down
18	-	Not used
19	-	Not used
20	GND	Ground

Connector X8

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LAT-/PA	Lateral or PA image in cephalo
4	CEPHROK-	
5	CEPHCOK-	Cephalo cassette sensor
6	CEPHLOK-	
7	CEPHMIDSW	Cephalo movement sensor
8	CEPHLIMSW	Cephalo movement sensor
9	CEPENA	Cephalo stepper motor drive enable
10	CEPHDIR	Ceph stepper motor drive direction

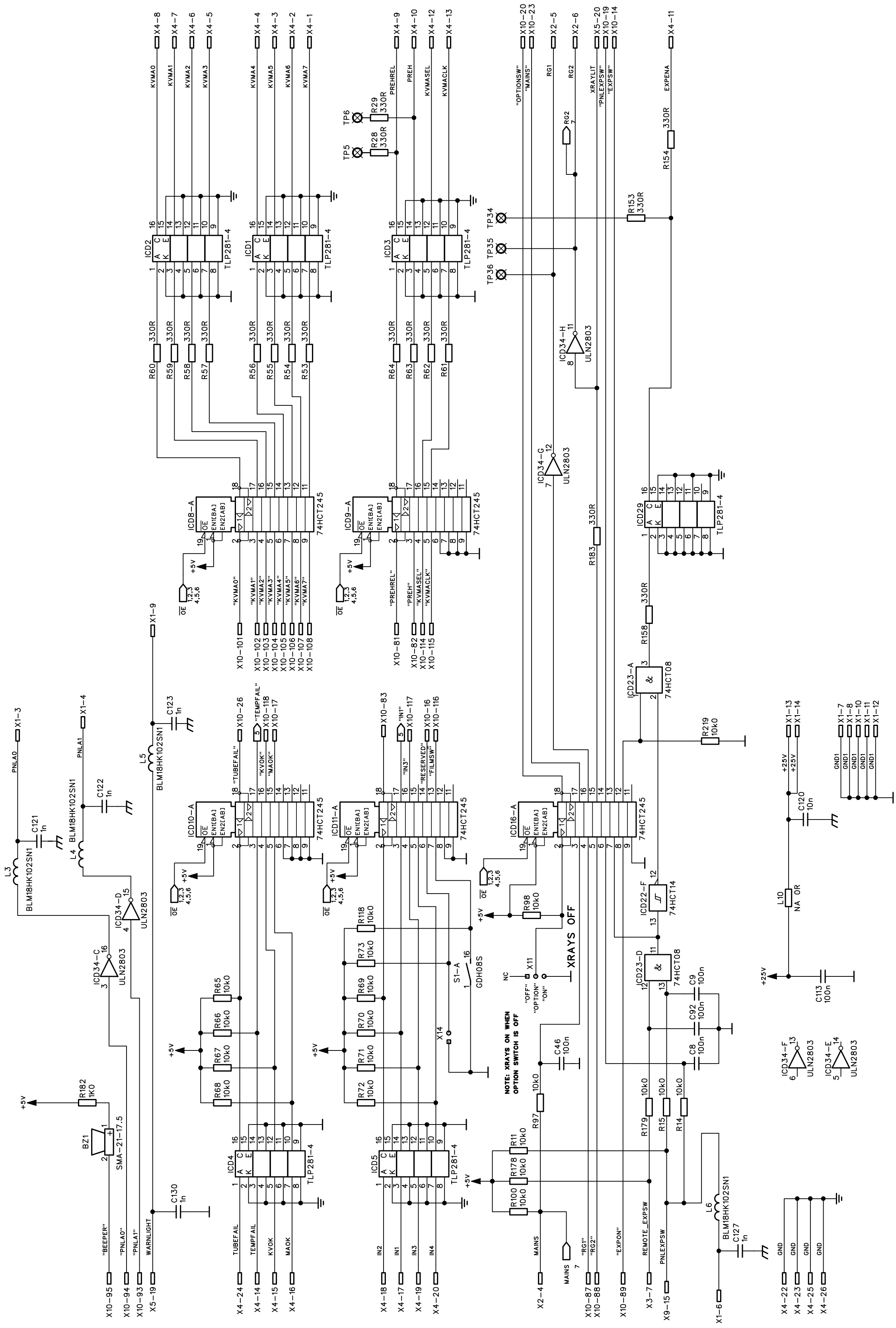
11	Not used	
12	CPPROJTRIG-	
13	FILT5	
14	CAECRFRQ	Cephalo frequency
15	-	Not used
16	-	Not used
17	CEPHUP-	Z movement up
18	CEPHDOWN	Z movement down
19	+5V	Power supply voltage
20	GND	Ground
21	CPOWER-	Ceph-CCD power active
22	CIMAGE-	Ceph-CCD image active
23	CEPHCLK	Cephalo stepper motor clock
24	CDETCLK	CCD detector clock
25	CLASLIT	Enables head size measurement
26	GND	Ground

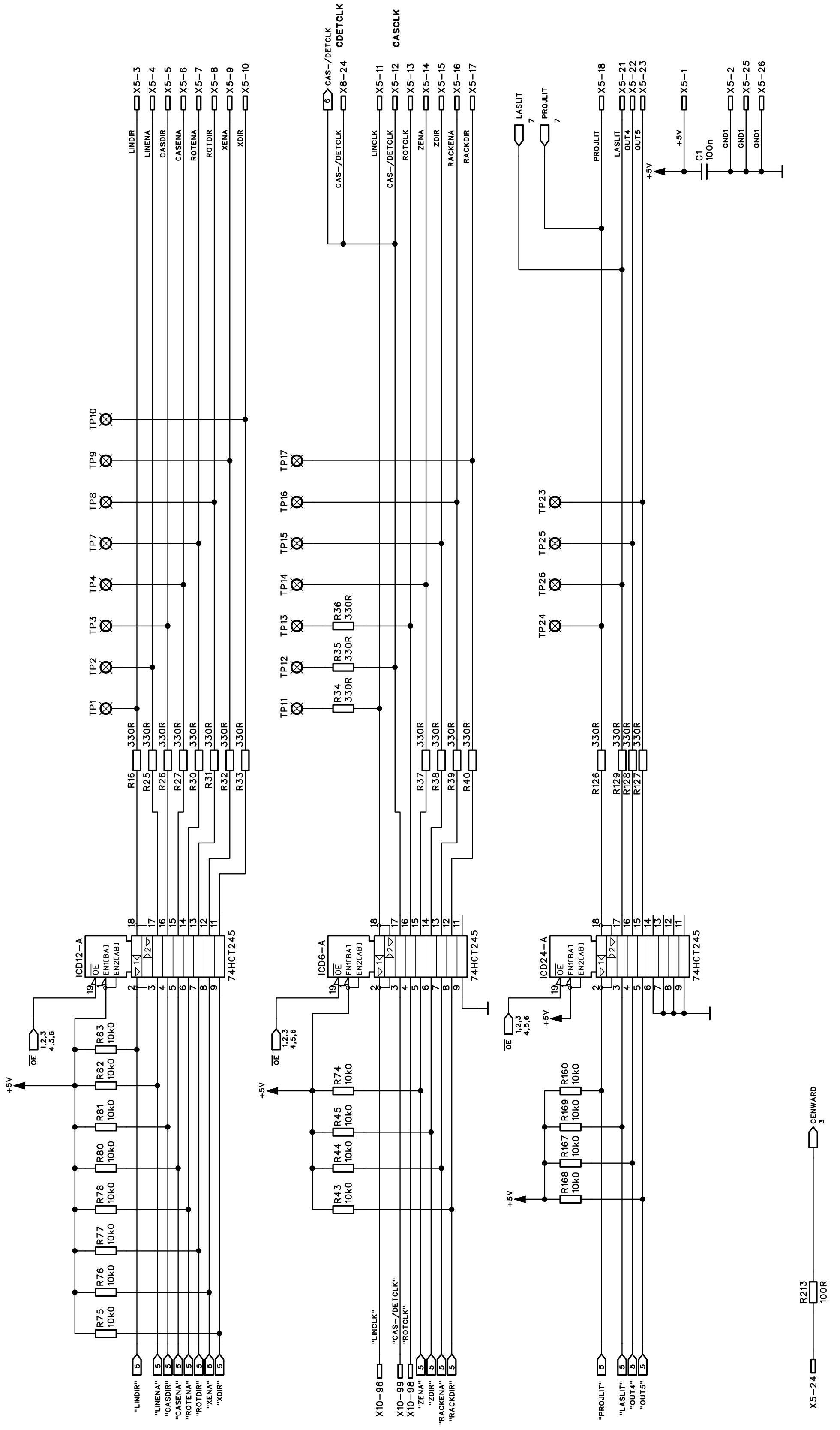
Connector X9

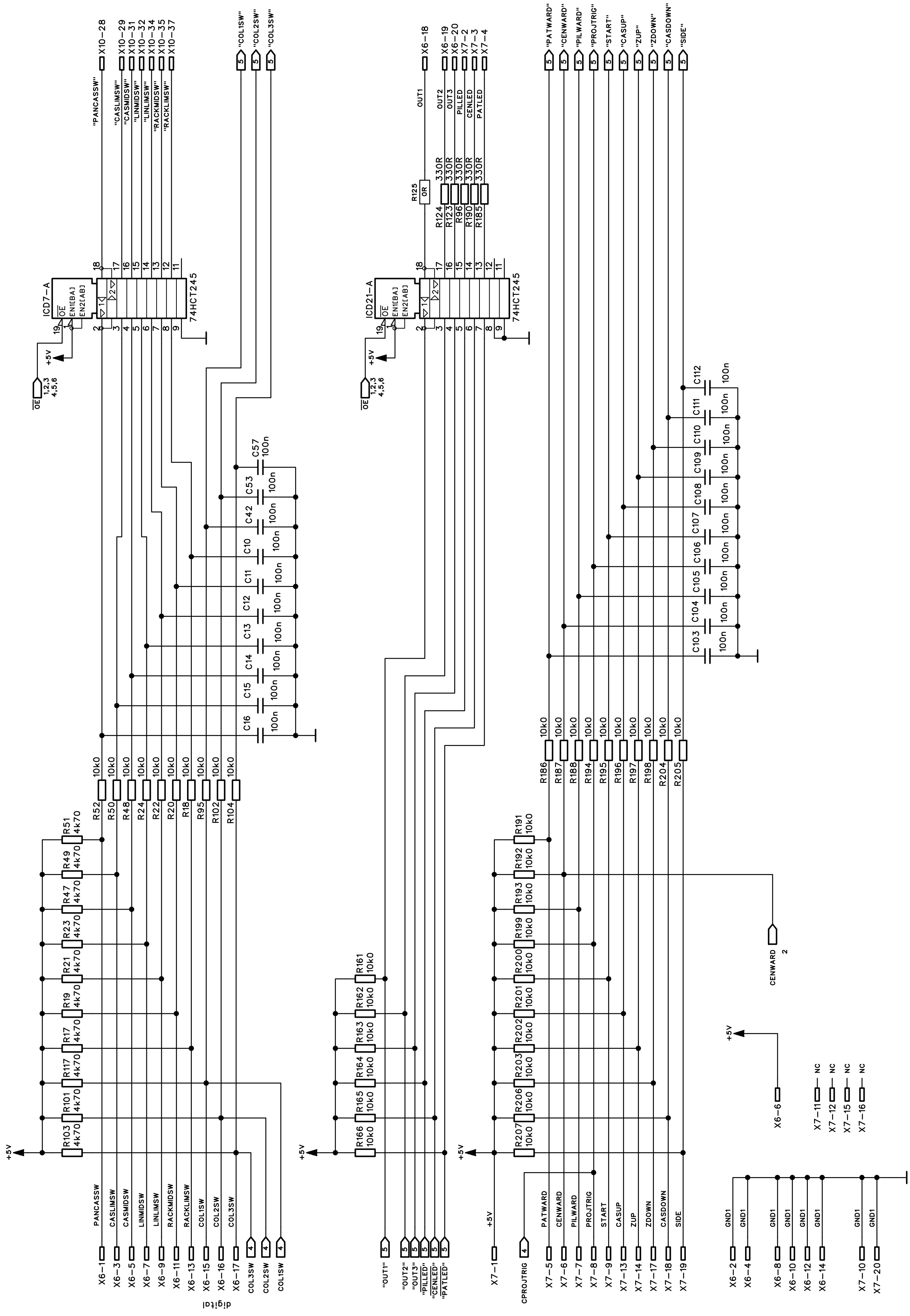
Pin	Signal	Description
1	ROT4SW	Rotation movement sensor4
2	GND	Ground
3	ROT3SW	Rotation movement sensor3
4	GND	Ground
5	ROT2SW	Rotation movement sensor2
6	GND	Ground
7	ROT1SW	Rotation movement sensor1
8	GND	Ground
9	ZLIMSW	Z-movement sensor (bottom)
10	GND	Ground
11	ZMIDSW	Z-movement sensor (top)
12	GND	Ground
13	+5V	Power supply voltage
14	GND	Ground
15	-	Not used
16	GND	Ground
17	-	Not used
18	GND	Ground
19	-	Not used
20	GND	Ground

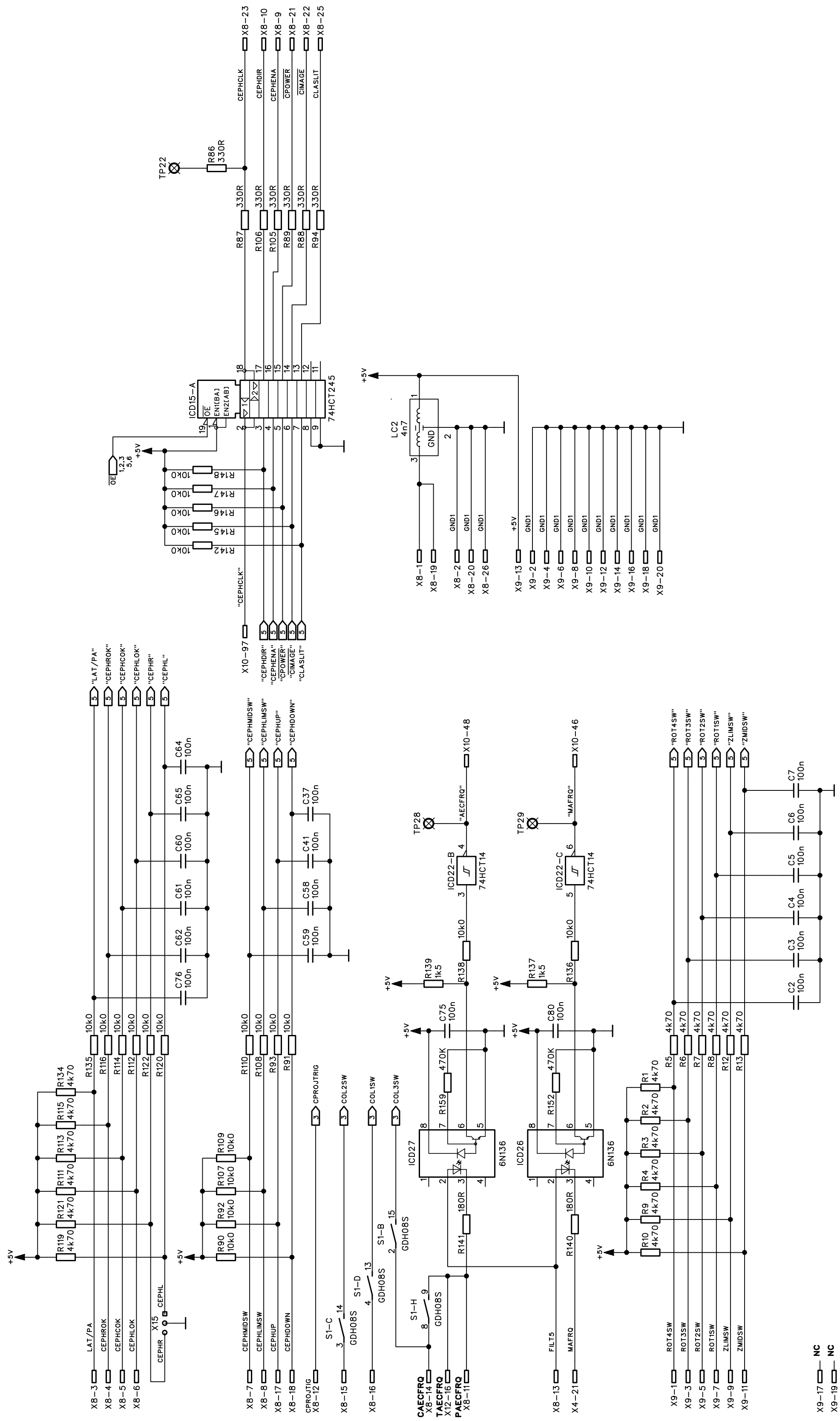
Connector X12

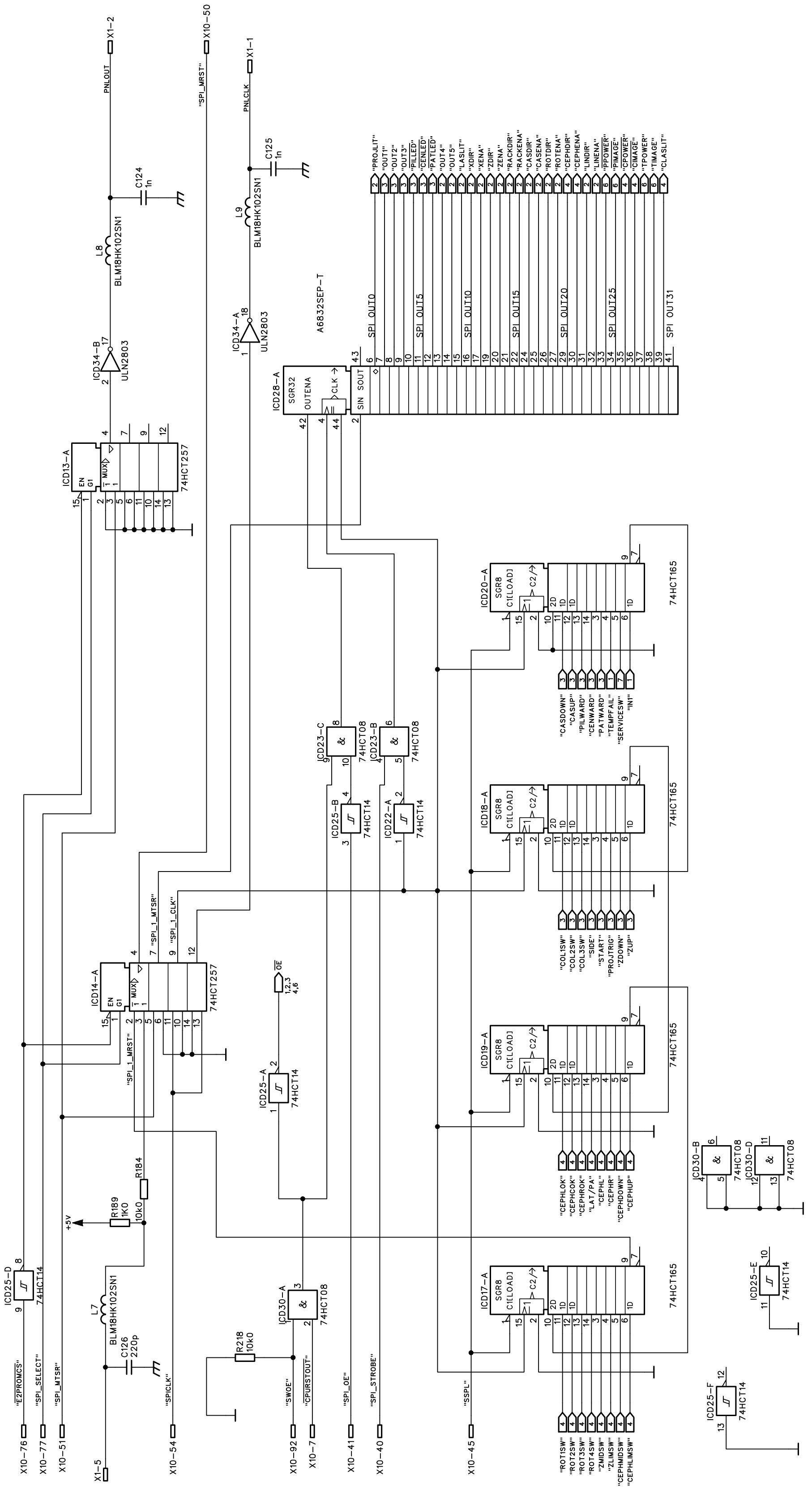
1	PDETCLK	CCD detector clock
2	PPOWER-	Pan-CCD power enable
3	PIMAGE-	Pan-CCd image enable
4	+5V	Power supply voltage
5	TXD2	Transmit data signal
6	RXD2	Receive data signal
7	+5V	Power supply voltage
8	GND	
9	GND	
10	GND	
11	NC	Not used
12	NC	Not used
13	NC	Not used
14	NC	Not used
15	NC	Not used
16	KV_FRQ	kVpreset-frequence

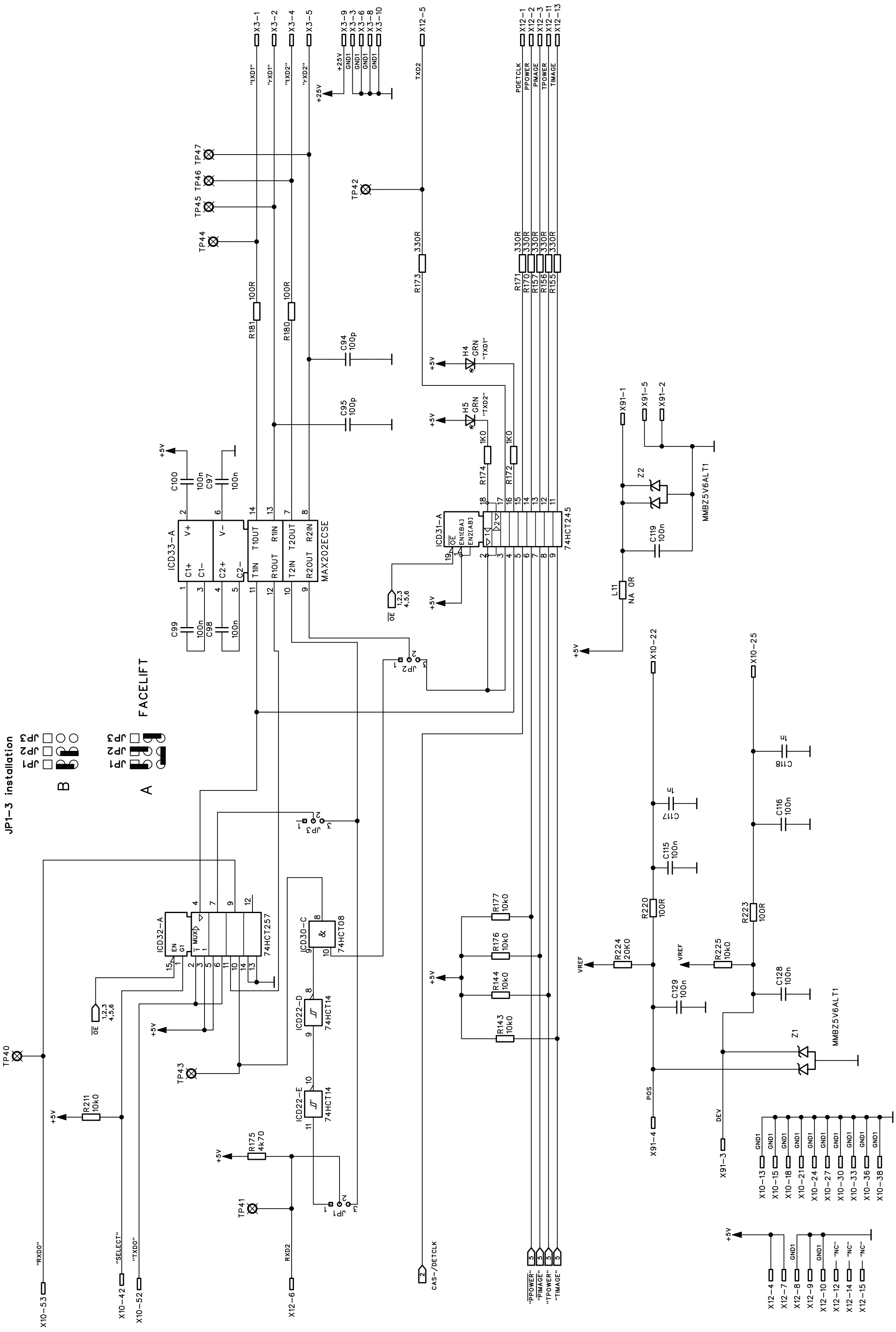

XRAYS OFF
NOTE: XRAYS ON WHEN OPTION SWITCH IS OFF

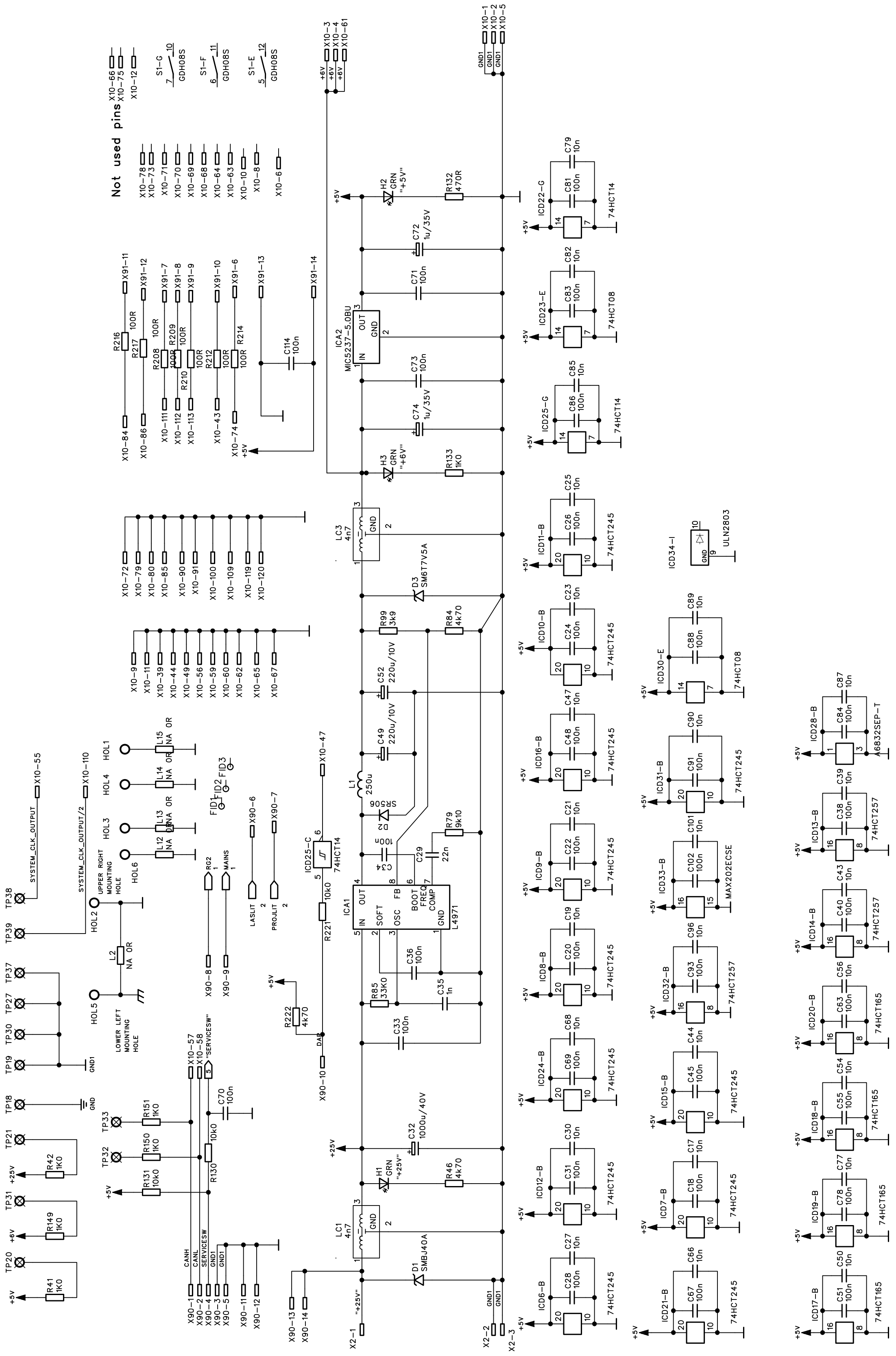


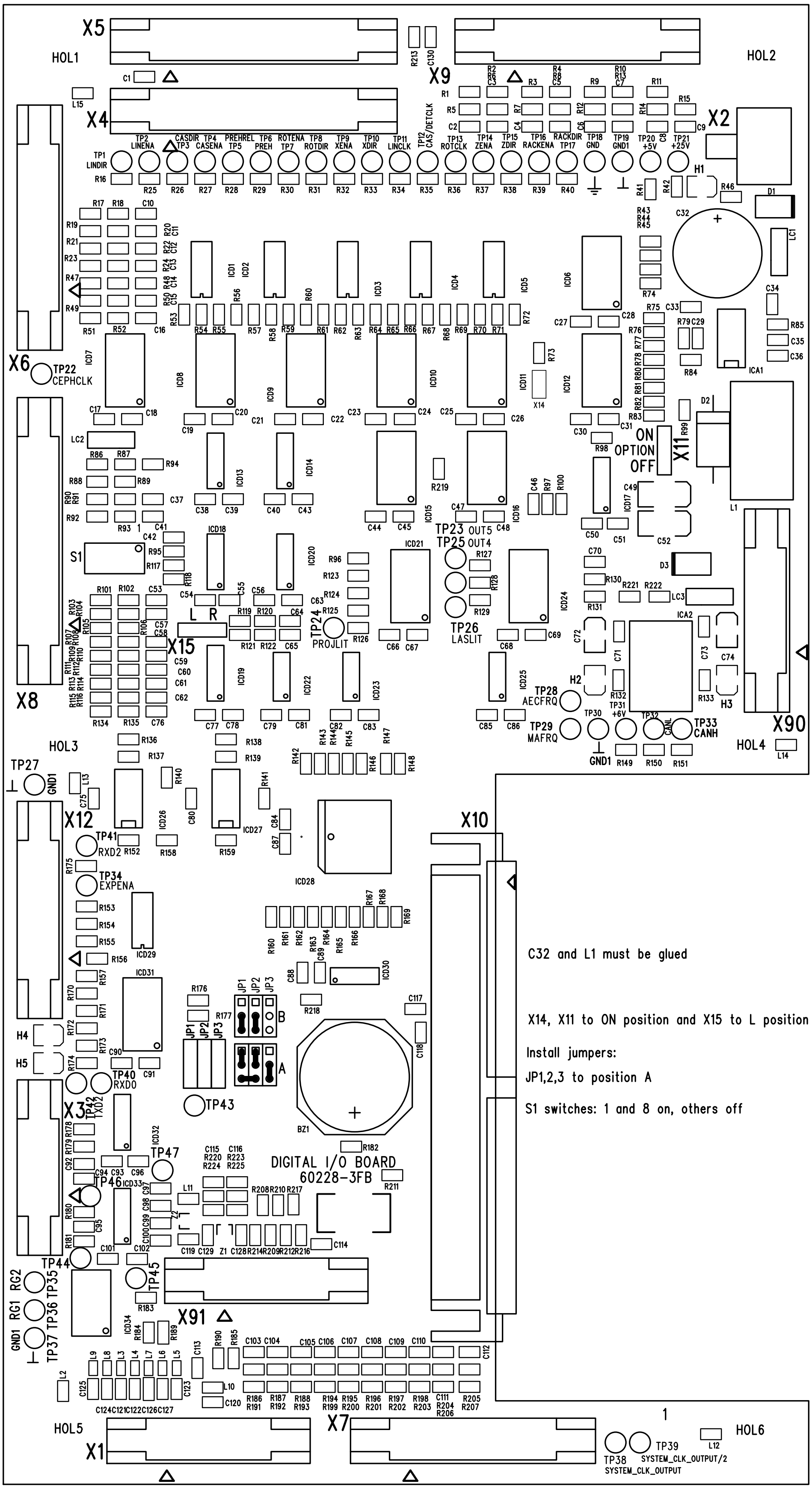

ICD7-A
74HCT245
ICD21-A
74HCT245
CENWARD
digital











C32 and L1 must be glued

X14, X11 to ON position and X15 to L position

Install jumpers:
JP1,2,3 to position A

S1 switches: 1 and 8 on, others off

N5300 Top Rack board

N5300 Location

In upper shelf.
To access, remove upper shelf plastic cover by removing the four screws on the top and the the metal cover exposed by removing the 10 screws..

N5300 Field replaceable parts

None.

N5300 Description

TheTop Rack board comprised a number of connectors. The main purpose of the board is to connect the signals that pass through the cables in the large cable bundle to the electronics in the Z-carriage. The other end of the cable bundle is located on the Rotation Connector board.

The measurement of a patient's head size is implemented using a AD654 V/f-converter.

The circuit allows a lower imput voltage (minimum 4 volts) than the supply voltage (+5V). An emitter follower generates the required additional voltage (+1V).
A potentiometer slider has been used to swing the input voltage (+0.5V … +1.0V). The frequency in the output of AD654 depends on the position of the slider.

Adjusting the frequency of the pan head support

Use **service program Sr 14 FrE** to check the frequency of the pan head support.
The frequency can be adjusted adjusted using trimmers Trim1 and Trim2.
The frequency limits are 2100Hz and 4000Hz. The full scale frequency (4000Hz ±100Hz) must be adjusted **before** the low scale frequency (2100Hz ±100Hz).

N5300 Indicator leds

None

N5300 Test points

TP	Signal	Description
TP1	GND	-

N5300 Jumpers

JP1	1-2	Right cephalo
	2-3	Left cephalo

N5300 Connectors

Connector J5301

Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	-25V	Power supply voltage
6	GND	Ground

Connector J5302

Pin	Signal	Description
1	+25V	Power supply voltage
2	GND	Ground
3	GND	Ground
4	RG2	310Vdc relay control
5	RG1	310Vdc relay control
6	MAINS	110/230V information

Connector J5303

Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	+34V	Power supply voltage
4	GND	Ground
5	+25V	Power supply voltage
6	GND	Ground
7	-25V	Power supply voltage
8	GND	Ground

Connector J5304

Pin	Signal	Description
1	GND	Ground
2	GND	Ground
3	+25V	Power supply voltage
4	GND	Ground
5	+34V	Power supply voltage
6	12VacGND	Ground
7	12Vac1	Power supply voltage
8	RG2	310Vdc relay control
9	RG1	310Vdc relay control
10	Mains	110/230V information
11	GND	Ground
12	GND	Ground
13	+25V	Power supply voltage
14	GND	Ground

Connector J5305

Pin	Signal	Description
1	LIN1	Phase1 for y-layer movement motor
2	LIN2	Phase2 for y-layer movement motor
3	LIN3	Phase3 for y-layer movement motor
4	LIN4	Phase4 for y-layer movement motor

Connector J5306

Pin	Signal	Description
1	CAS1	Phase1 for collimator movement motor
2	CAS2	Phase2 for collimator movement motor
3	CAS3	Phase3 for collimator movement motor
4	CAS4	Phase4 for collimator movement motor
5	ROT1	Phase1 rotation movement motor
6	ROT2	Phase2 rotation movement motor
7	ROT3	Phase3 rotation movement motor
8	ROT4	Phase4 rotation movement motor

Connector J5309

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	SOLOK-	Solenoid ok
4	-	-
5	PROJLIT	Patient position light enable
6	-	-
7	AEC_FRQ_TO_CPU	Frequency
8	GND	Ground
9	TXD2	Transmit data signal
10	RDX2	Receive data signal
11	GND	Ground
12	PDETCLK	CCD detector clock
13	GND	Ground
14	PPOWER-	Pan-CCD power active
15	PIMAGE-	Pan-CCD image active
16	GND	Ground

Connector J5310

Pin	Signal	Description
1	PDETCLK	CCD detector clock
2	PPOWER-	Pan-CCD power enable
3	PIMAGE-	Pan-CCd image enable
4	+5V	Power supply voltage
5	TXD2	Transmit data signal
6	RXD2	Receive data signal
7	+5V	Power supply voltage
8	GND	
9	GND	
10	GND	
11	-	-
12	-	-
13	-	-
14	-	-
15	-	-
16	KV_FRQ	kVpreset-frequence

Connector J5312

Pin	Signal	Description
1	+5V	Power supply voltage
2	YSENS1-	Y-layer movement sensor1
3	YSENS2-	Y-layer movement sensor2
4	YSENS3-	Y-layer movement sensor3
5	-	-
6	GND	Ground

Connector J5313

Pin	Signal	Description
1	-	-
2	GND	Ground
3	-	-
4	GND	Ground
5	-	-
6	-	-
7	LINMID Sw	Z-movement sensor (top)
8	GND	Ground
9	LINLIM Sw	Z-movement sensor (bottom)
10	GND	Ground
11	-	-
12	GND	Ground
13	-	-
14	GND	Ground
15	COL1 Sw	Collimator sensor 1
16	COL2 Sw	In normal use = COL3 Sw
17	COL3 Sw	Collimator sensor 3 (JP2 normal position)
18	SOLENA	Solenoid enable
19	KV_FRQ_ENA	
20	-	-

Connector J5314

Pin	Signal	Description
1	ROT4SW	Rotation movement sensor4
2	GND	Ground
3	ROT3SW	Rotation movement sensor3
4	GND	Ground
5	ROT2SW	Rotation movement sensor2
6	GND	Ground
7	ROT1SW	Rotation movement sensor1
8	GND	Ground
9	ZLIMSW	Z-movement sensor (bottom)
10	-	-

11	ZMIDSW	Z-movement sensor (top)
12	GND	Ground
13	+5V	Power supply voltage
14	GND	Ground
15	-	-
16	GND	Ground
17	-	Not used
18	GND	Ground
19	-	-
20	GND	Ground

Connector J5316

Pin	Signal	Description
1	-	-
2	-	-
3	-	-
4		
5		
6	COL1SW	Collimator sensor1
7	+5V	Power supply voltage
8	COL13W	Collimator sensor2
9	SOLENA-	Solenoid enable
10	GND	Ground
11	-	Not used
12	ROT1SW	Rotation movement sensor1
13	ROT2SW	Rotation movement sensor2
14	ROT3SW	Rotation movement sensor3
15	ROT4SW	Rotation movement sensor4
16	-	-

Connector J5317

Pin	Signal	Description
1	GND	Ground
2	ZLIMSW	Z-movement sensor (bottom)

Connector J5318

Pin	Signal	Description
1	GND	Ground
2	ZMIDSW	Z-movement sensor (top)

Connector J5319

Pin	Signal	Description
1	kVmA7	Digital kV and mA references
2	kVmA6	Digital kV and mA references
3	kVmA5	Digital kV and mA references
4	kVmA4	Digital kV and mA references
5	kVmA3	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA1	Digital kV and mA references
8	kVmA0	Digital kV and mA references
9	Prehrel	Preheat relay control
10	Preh	Preheat control
11	Expena	Exposure enable
12	kVmAsel	Select kV or mA
13	kVmAclk	Clock
14	Tempfail	Temperature too high
15	kVok	KV control is ok
16	mAok	MA control is ok
17	-	-
18	SOLOK-	
19	MIRROR-	Patient mirror closed
20	-	-
21	mAfrq	current to frequency information
22	GND	Ground
23	GND	Ground
24	Tubefail	Failure in tube head
25	GND	Ground
26	GND	Ground

Connector J5320

Pin	Signal	Description
1	kVmA7	Digital kV and mA references
2	kVmA6	Digital kV and mA references
3	kVmA5	Digital kV and mA references
4	kVmA4	Digital kV and mA references
5	kVmA3	Digital kV and mA references
6	kVmA2	Digital kV and mA references
7	kVmA1	Digital kV and mA references
8	kVmA0	Digital kV and mA references
9	Prehrel	Preheat relay control
10	Preh	Preheat control
11	Expena	Exposure enable
12	kVmAsel	Select kV or mA
13	kVmAclk	Clock
14	Tempfail	Temperature too high
15	kVok	KV control is ok

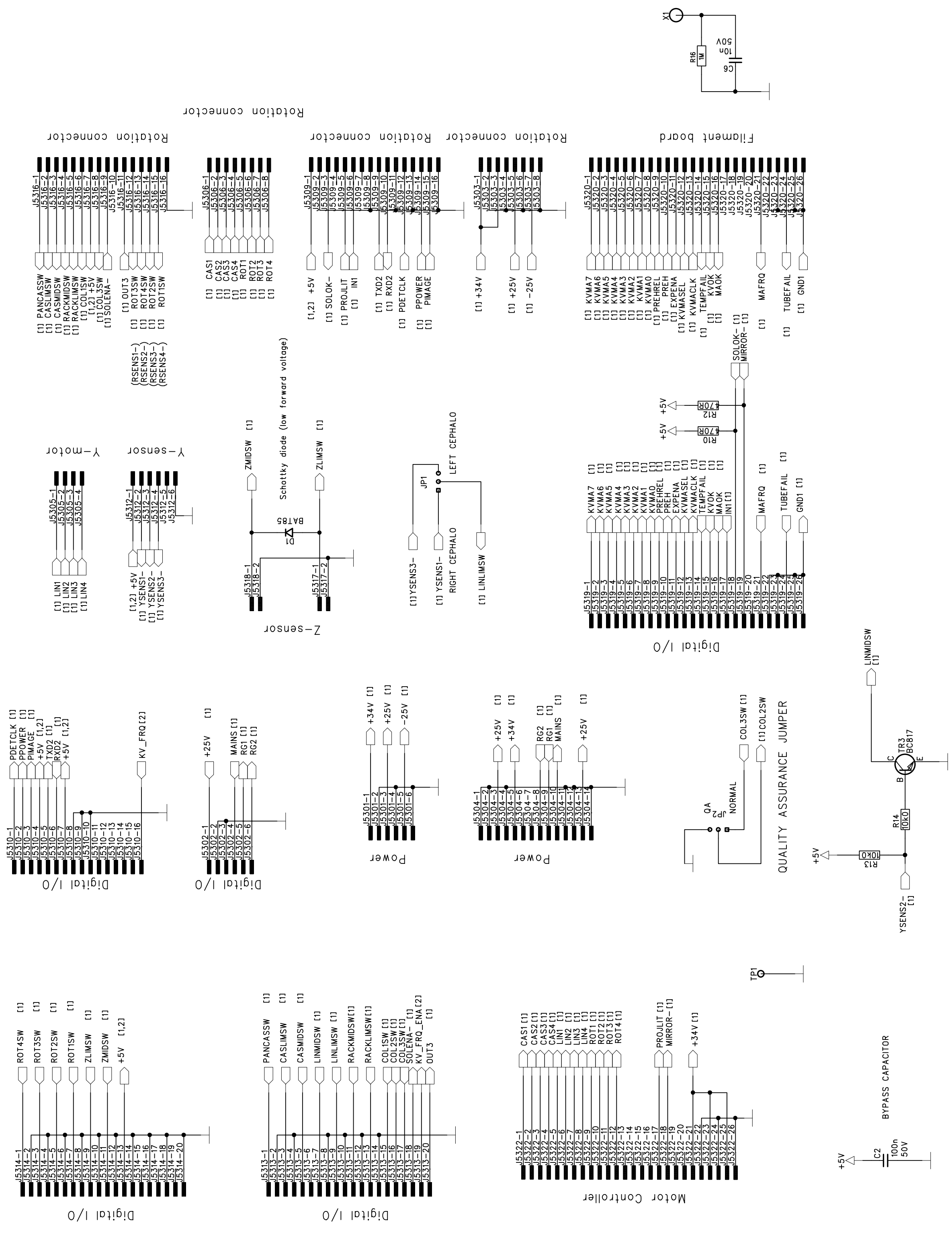
16	mAok	MA control is ok
17	-	-
18	-	-
19	-	-
20	-	-
21	mAfrq	current to frequency information
22	GND	Ground
23	GND	Ground
24	Tubefail	Failure in tube head
25	GND	Ground
26	GND	Ground

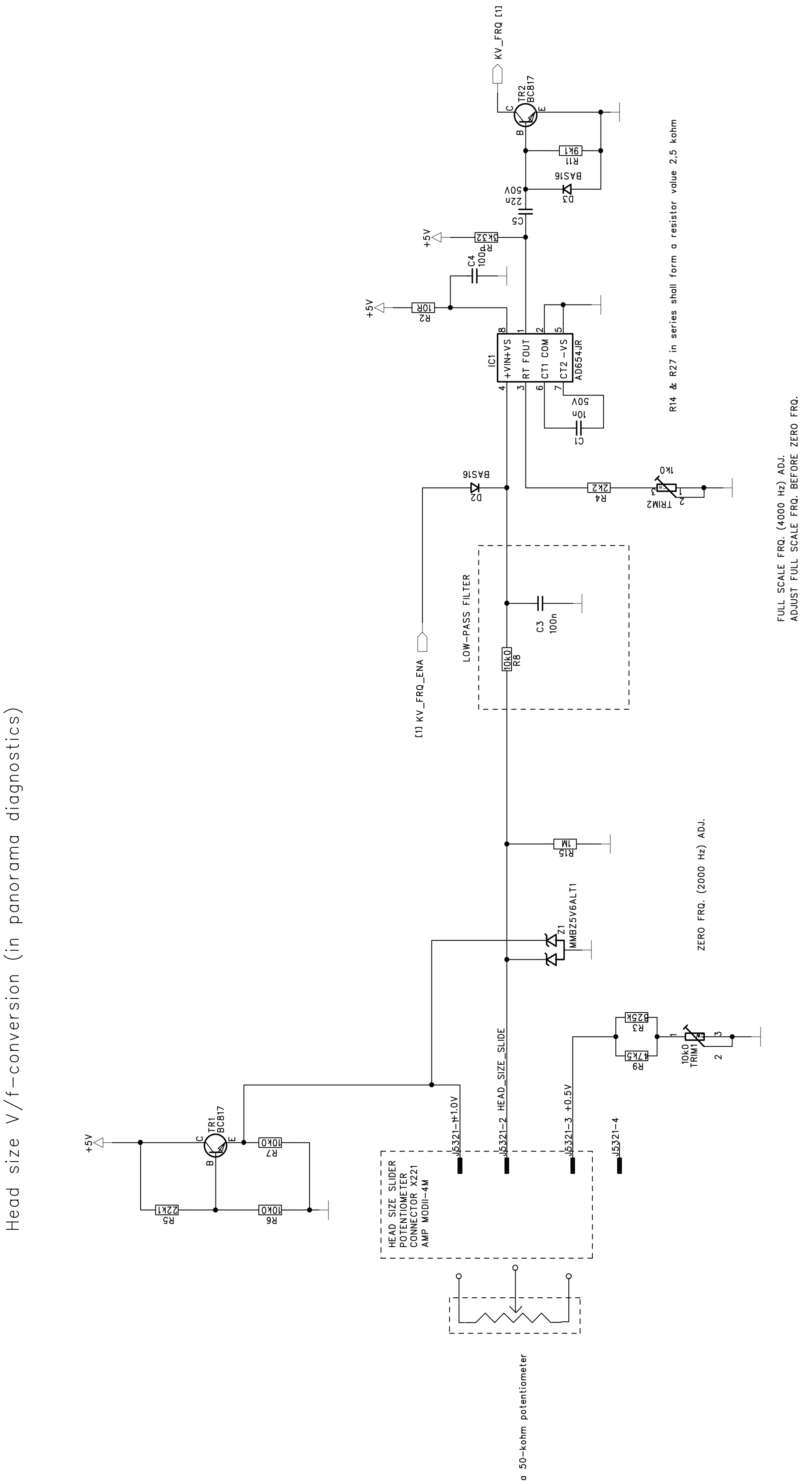
Connector J5321

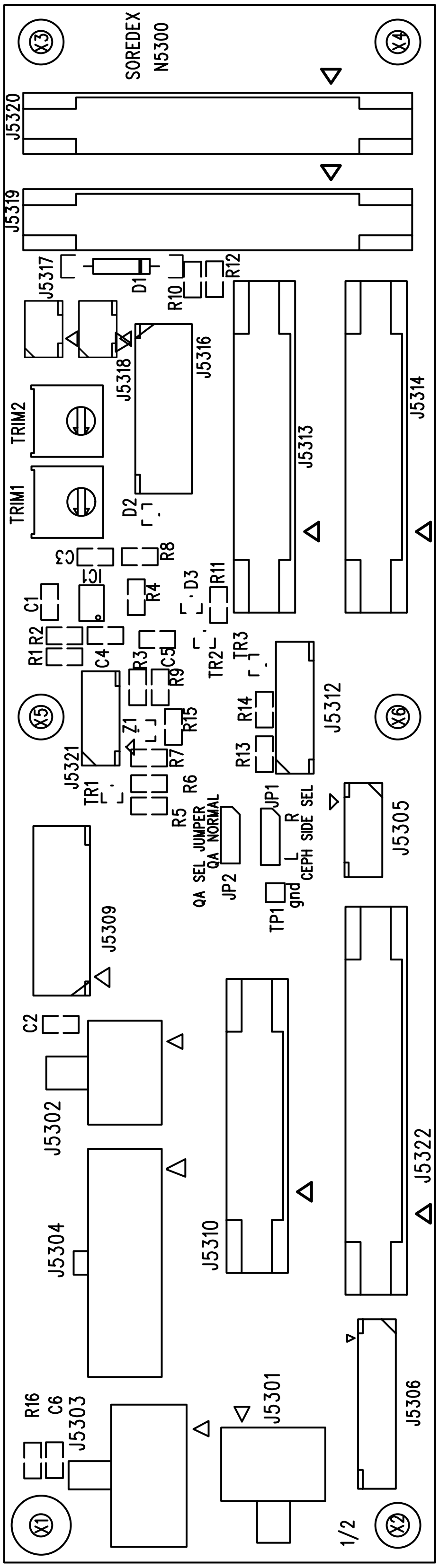
Pin	Signal	Description
1	+1V	
2	HEAT_SIDE_SLIDE	
3	+0.5V	
4	-	-

Connector J5322

Pin	Signal	Description
1	CAS1	Phase1 for collimator movement motor
2	CAS2	Phase2 for collimator movement motor
3	CAS3	Phase3 for collimator movement motor
4	CAS4	Phase4 for collimator movement motor
5	LIN1	Phase1 for linear movement motor
6	LIN2	Phase2 for linear movement motor
7	LIN3	Phase3 for linear movement motor
8	LIN4	Phase4 for linear movement motor
9	ROT1	Phase1 rotation movement motor
10	ROT2	Phase2 rotation movement motor
11	ROT3	Phase3 rotation movement motor
12	ROT4	Phase4 rotation movement motor
13	-	-
14	-	-
15	-	-
16	Not used	
17	PROLIT	Patient position light enable
18	MIRROR-	Patient mirror closed
19	-	-
20	-	-
21	+34V	Power supply voltage
22	GND	Ground
23	+34V	Power supply voltage
24	GND	Ground
25	+34V	Power supply voltage
26	GND	Ground


Rotation connector
Filament board
Y-motor
Y-sensor
Z-sensor
Schottky diode (low forward voltage)
LEFT CEPHALO
RIGHT CEPHALO
Digital I/O
Power
QUALITY ASSURANCE JUMPER
Motor Controller
BYPASS CAPACITOR


Head size V/f-conversion (in panorama diagnostics)
KV_FRQ [1]
TR2
BC817
R11
9K1
D3
BAS16
C5
22n
50V
+5V
R1
5K32
C4
100p
R2
10R
IC1
+VIN+VS
RT FOUT
CT1 COM
CT2 -VS
AD654JR
C1
10n
50V
R14 & R27 in series shall form a resistor value 2,5 kohm
D2
BAS16
R4
2K2
TRIM2
1K0
FULL SCALE FRQ. (4000 Hz) ADJ.
ADJUST FULL SCALE FRQ. BEFORE ZERO FRQ.
LOW-PASS FILTER
C3
100n
R8
10k0
[1] KV_FRQ_ENA
R15
1M
Z1
MMBZ5V6ALT1
ZERO FRQ. (2000 Hz) ADJ.
R3
825K
R9
47K5
TRIM1
10k0
HEAD_SIZE_SLIDE
J5321-1 +1.0V
J5321-2
J5321-3 +0.5V
J5321-4
TR1
BC817
R7
10k0
R5
22K1
R6
10k0
HEAD SIZE SLIDER
POTENTIOMETER
CONNECTOR X221
AMP MODII-4M
a 50-kohm potentiometer


SOREDEX
N5300
J5320
J5319
J5317
D1
R10
R12
J5318
J5316
J5313
J5314
TRIM2
TRIM1
D2
C3
R8
IC1
R4
D3
R11
C1
R1
R2
C4
R3
C5
R9
TR2
TR3
Z1
R15
R14
J5312
J5321
R7
R13
TR1
R6
R5
QA SEL JUMPER
QA NORMAL
JP2
JP1
R
L
CEPH SIDE SEL
TP1
gnd
J5305
J5309
C2
J5302
J5310
J5322
J5304
R16
C6
J5303
J5301
J5306
1/2
X1
X2
X3
X4
X5
X6

N5400 Tubehead board

N5400 Location

In the tubehead.
Can not be accessed.

N5400 Field replaceable parts

None

N5400 Description

The Tubehead board is sealed inside the tubehead and cannot be accessed.
The board supplies the high voltage and high current to the tube.

On the board there is a high voltage and high frequency transformer which is driven by an inverter board. The high voltage is multiplied by 16 using two diode-capacitor multiplying circuits. The tubehead voltage can be adjusted between 57-85kV. The cathode end of the tube is connected to a filament transformer and the filament board drives the current through it.

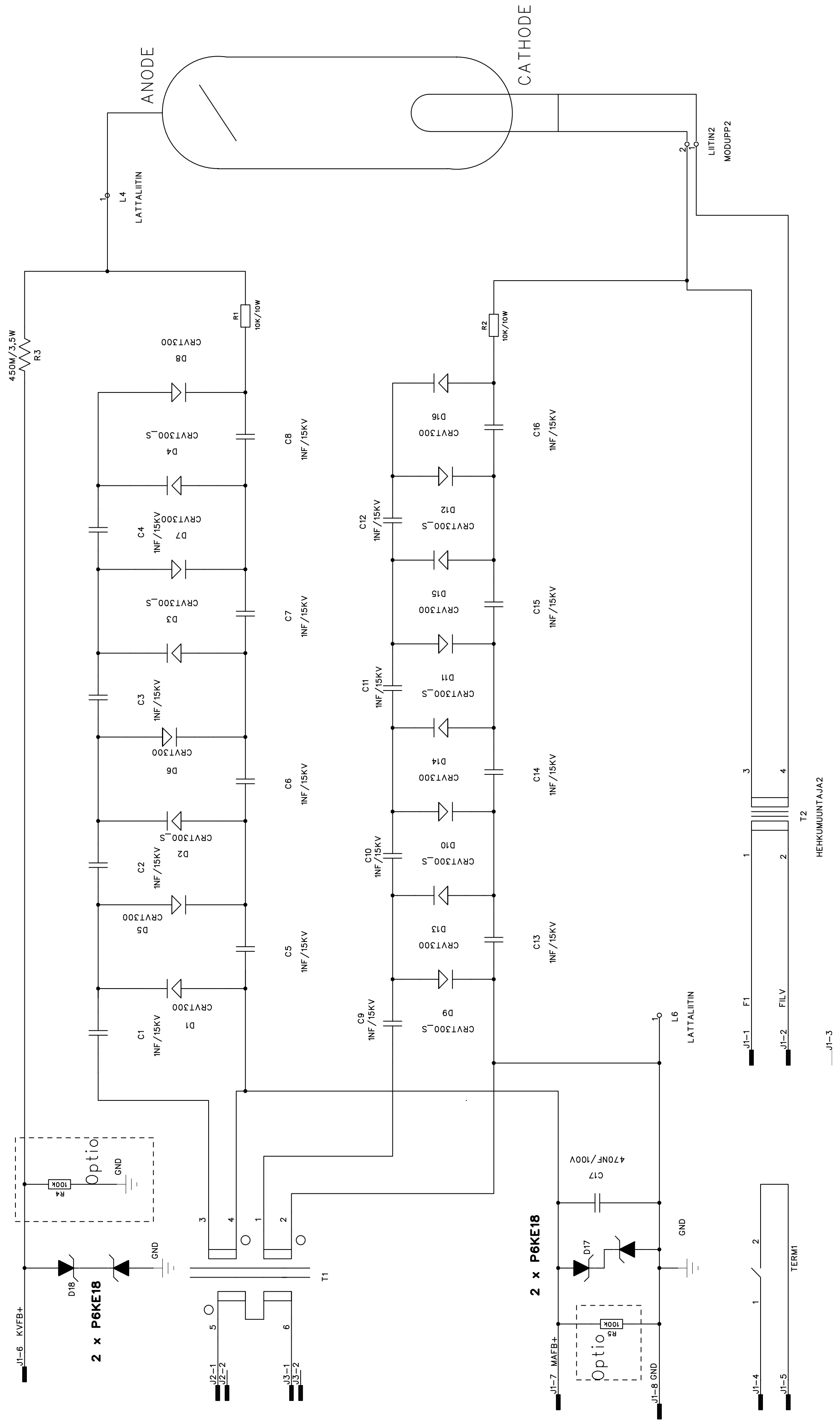
The Tubehead board also has a thermistor which will open if the oil in the tubehead becomes too hot. Usually it will take a couple of hours for the oil to cool sufficiently for the termistor to close and tubehead to return to its normal state.

N5400 Indicator leds

None

N5400 Test points

None


ANODE
CATHODE
LATTALIITIN
LIITIN2
MODUPP2
HEHKUMUUNTAJA2
T2
T1
TERM1
Optio
2 x P6KE18
2 x P6KE18
J1-6 KVFB+
J1-7 MAFB+
J1-8 GND

N5500 Collimator sensor board

N5500 Location

In collimator in front of the tubehead.
To access it remove tubehead cover.

N5500 Field replaceable parts

None

N5500 Description

The N5500 board is used to detect the collimator positions

N5500 Indicator leds /Test points

None

N5500 Connectors

Connector J5501

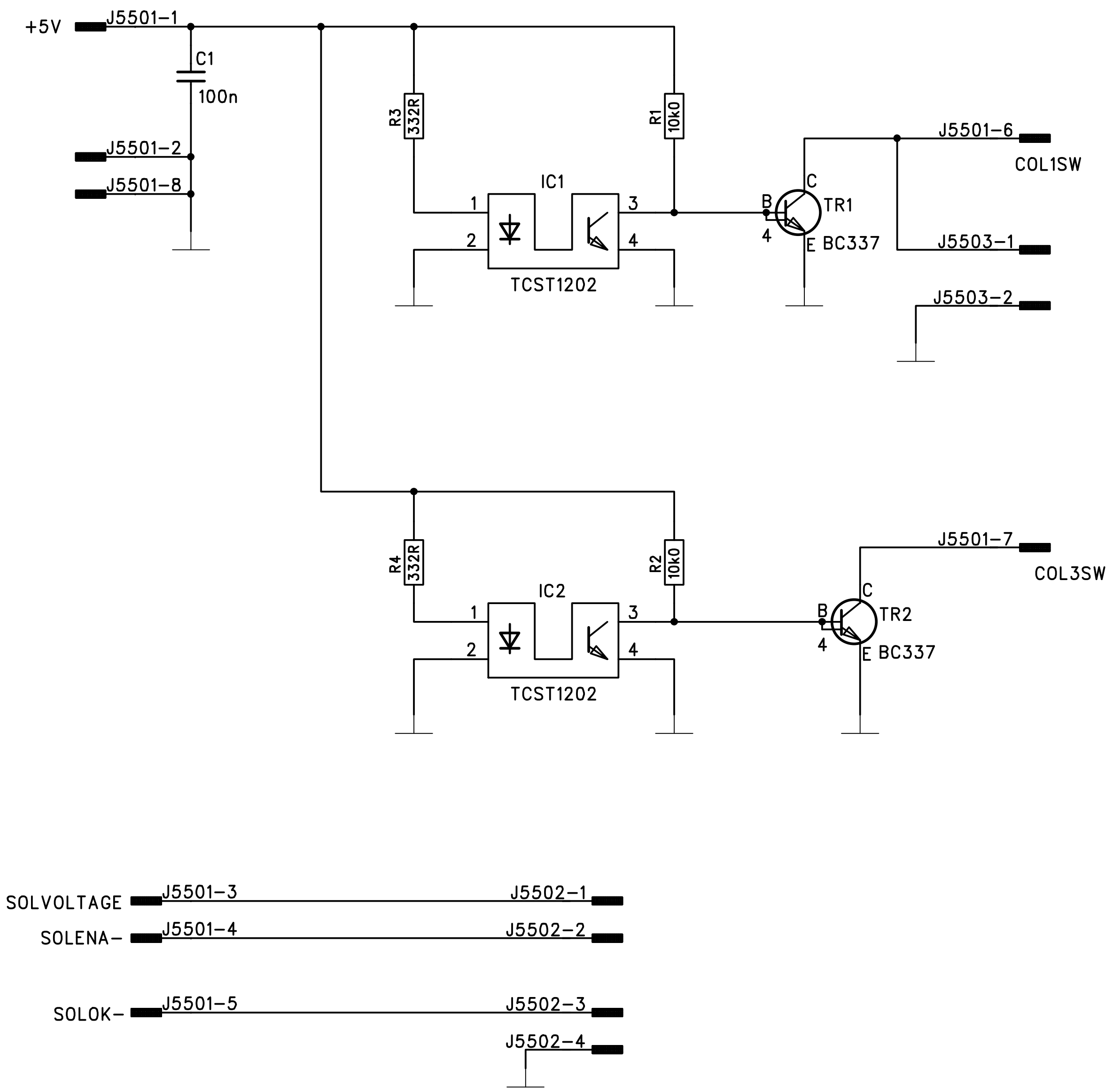
Pin	Signal	Description
1	+5V	
2	GND	
3	+25V	
4	solena-	Enable the child aperture solenoid
5	solok-	Child aperture on selected
6	col1sw	L=pan, H=ceph
7	col3sw	H=ceph, L=pan
8	GND	

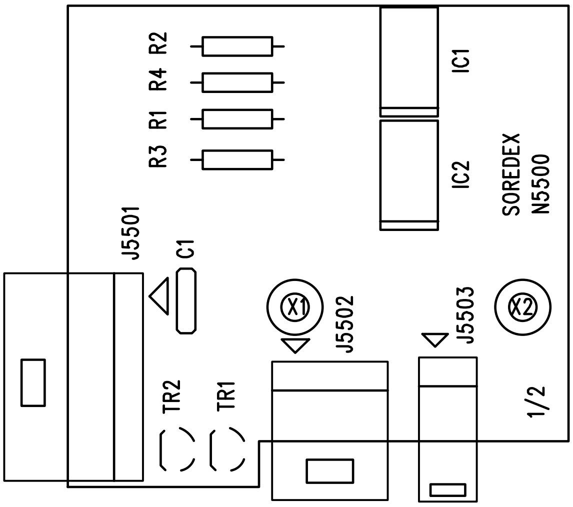
Connector J5502

Pin	Signal	Description
1	+25V	
2	solena-	Enable the child aperture solenoid
3	solok-	Child aperture on selected
4	GND	

Connector J5503

Pin	Signal	Description
1	col1sw	
2	GND	


+5V
J5501-1
C1
100n
J5501-2
J5501-8
R3
332R
R1
10k0
IC1
1
2
3
4
TCST1202
C
B
TR1
4
E BC337
J5501-6
COL1SW
J5503-1
J5503-2
R4
332R
R2
10k0
IC2
1
2
3
4
TCST1202
C
B
TR2
4
E BC337
J5501-7
COL3SW
SOLVOLTAGE
J5501-3
J5502-1
SOLENA-
J5501-4
J5502-2
SOLOK-
J5501-5
J5502-3
J5502-4


R2
R4
R1
R3
IC1
IC2
SOREDEX
N5500
J5501
C1
X1
J5502
J5503
X2
TR2
TR1
1/2

N5600 Sensor connector board

N5600 Location

Inside the CCD sensor

N5600 Field replaceable parts

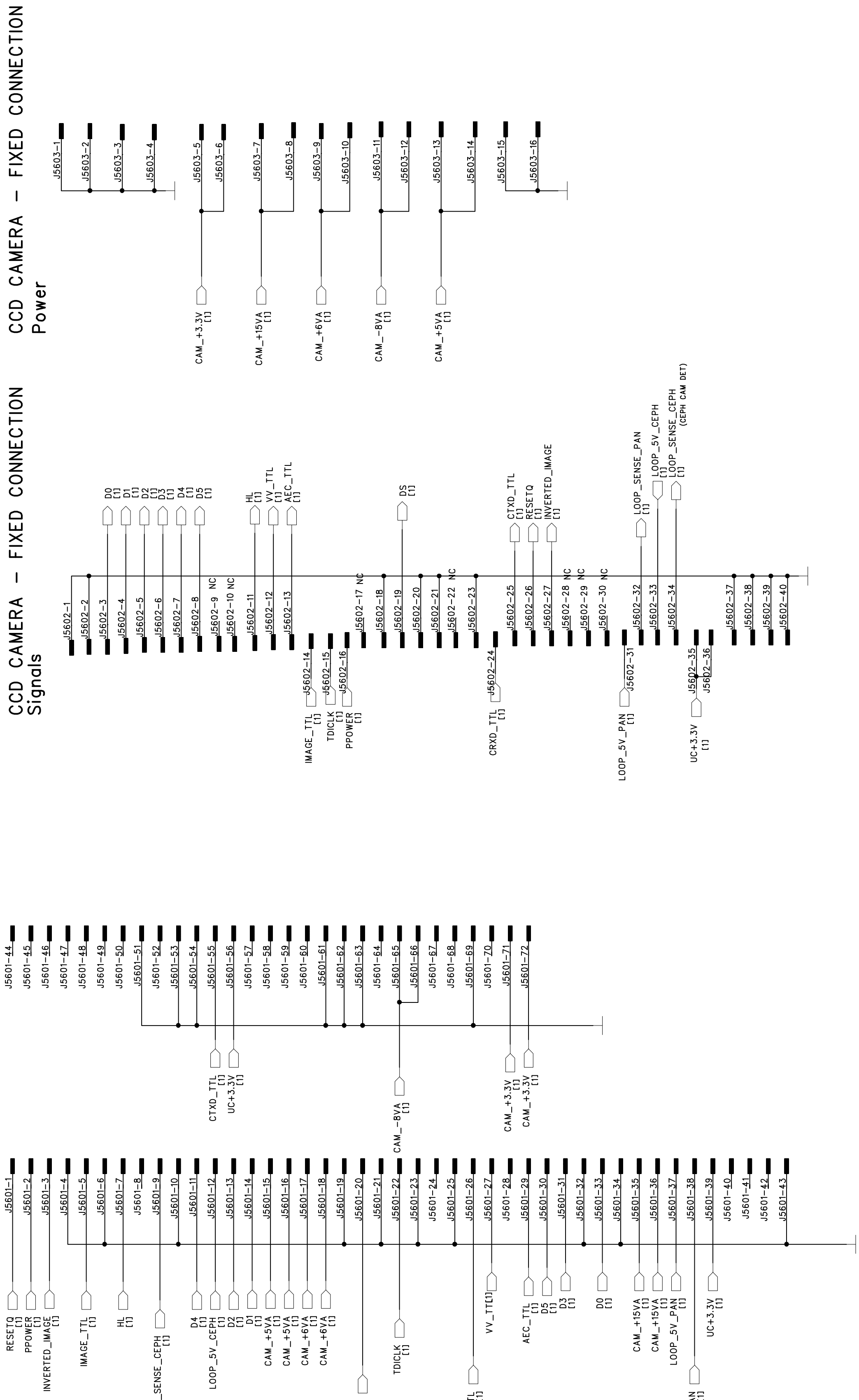
None

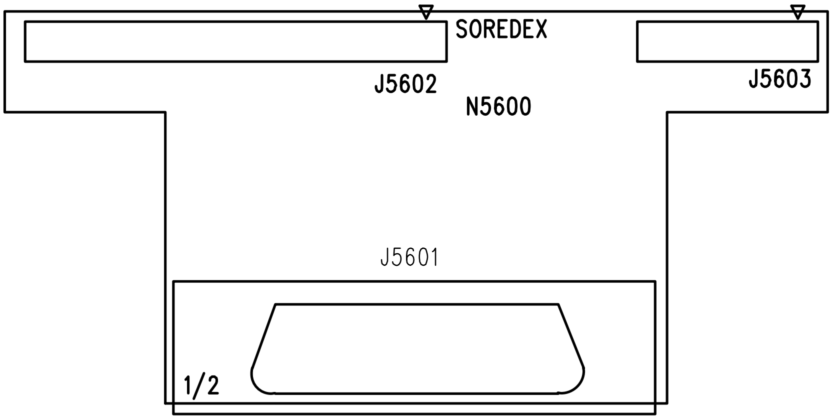
N5600 Description

The N5600 board serves as a connector between the CCD sensor and the unit (sensor holder) and allows the CCD sensor to be removed from the unit.

N5600 Indicator leds /Test points

None


CCD CAMERA – FIXED CONNECTION
Power
CCD CAMERA – FIXED CONNECTION
Signals


SOREDEX
J5602
J5603
N5600
J5601
1/2

N5700 DIB connector board

N5700 Location

Inside the CCD sensor holder in rotating part and in ceph head.

N5700 Field replaceable parts

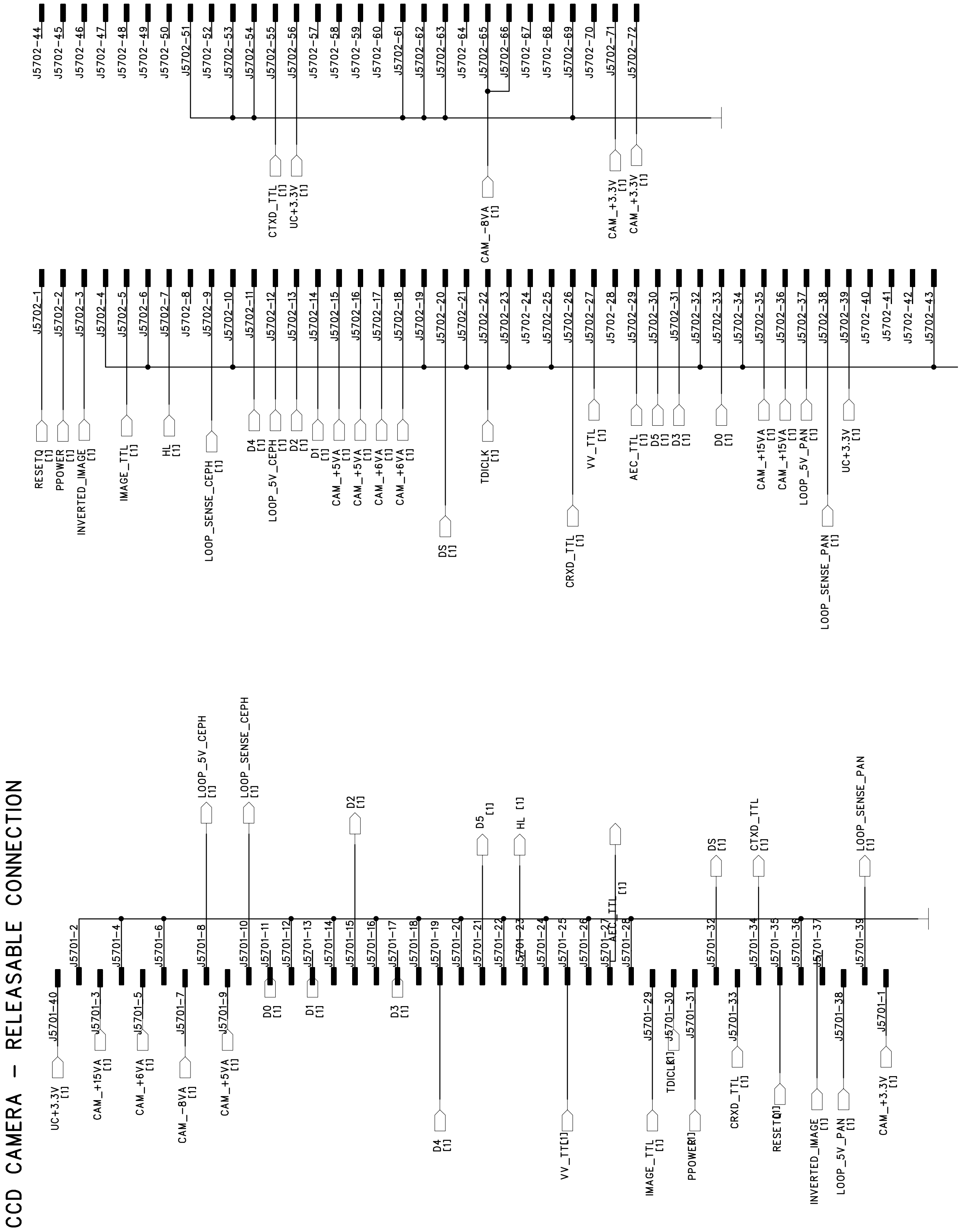
None

N5700 Description

The N5700 board serves as a connector between the CCD sensor and the unit (sensor holder) and allows the CCD sensor to be removed from the unit.

N5700 Indicator leds /Test points

None


CCD CAMERA - RELEASABLE CONNECTION
J5702-44 … J5702-72
CTXD_TTL [1]
UC+3.3V [1]
CAM_-8VA [1]
CAM_+3.3V [1]
CAM_+3.3V [1]
J5702-1 … J5702-43
RESETQ [1]
PPOWER [1]
INVERTED_IMAGE [1]
IMAGE_TTL [1]
HL [1]
LOOP_SENSE_CEPH [1]
D4 [1]
LOOP_5V_CEPH [1]
D2 [1]
D1 [1]
CAM_+5VA [1]
CAM_+5VA [1]
CAM_+6VA [1]
CAM_+6VA [1]
DS [1]
TDICLK [1]
CRXD_TTL [1]
VV_TTL [1]
AEC_TTL [1]
D5 [1]
D3 [1]
D0 [1]
CAM_+15VA [1]
CAM_+15VA [1]
LOOP_5V_PAN [1]
LOOP_SENSE_PAN [1]
UC+3.3V [1]
J5701-1 … J5701-40
CAM_-8VA [1]
CAM_+3.3V [1]

N5800 Data Interface board

N5800 Location

In the rotating unit and in ceph head.
To access remove the CCD sensor holder covers and with the ceph head also remove the metal cover shield on the board.

N5800 Field replaceable parts

None.

N5800 Description

Data interface board (DIB) serves as an interface between the terminal board and CCD detector. Image data signals from the CCD are converted into a differential mode while passing to the terminal board. TTL/RS-232 conversion is done to produce the control signals. Control signals from the terminal are converted back to TTL. The DIB also generates various supply voltages for the CCD: +3VA, +15VA, -9VA, +5VA, +3.3 V. The +3VA, +15VA, -9VA voltages are taken from the +18 V input.
There are two jumpers on the N5800 board, JP1 and JP2. Depending on where the DIB has been assembled, the jumpers will either be in the to PAN or CEPH position.

N5800 Test points

TP	Signal	Description
TP1	uC+3.3V	Permanent +3.3VDC for CCD
TP2	GND	
TP3	CTXD_RS232	TXD signal, RS-232 level
TP4	CRXD_RS232	RXD signal, RS-232 level
TP5	GND	
TP6	GND	
TP7	GND	
J5804.6	+3.3V	+3.3VDC
J5804.8	+15VA	Analog +15VA for the CCD
J5804.10	+3VA	Analog phase voltage (+3VA) for the CCD
J5804.12	-8VA	Analog phase voltage 8VA) for the CCD
J5804.14	+5VA	Analog +5VA for the CCD

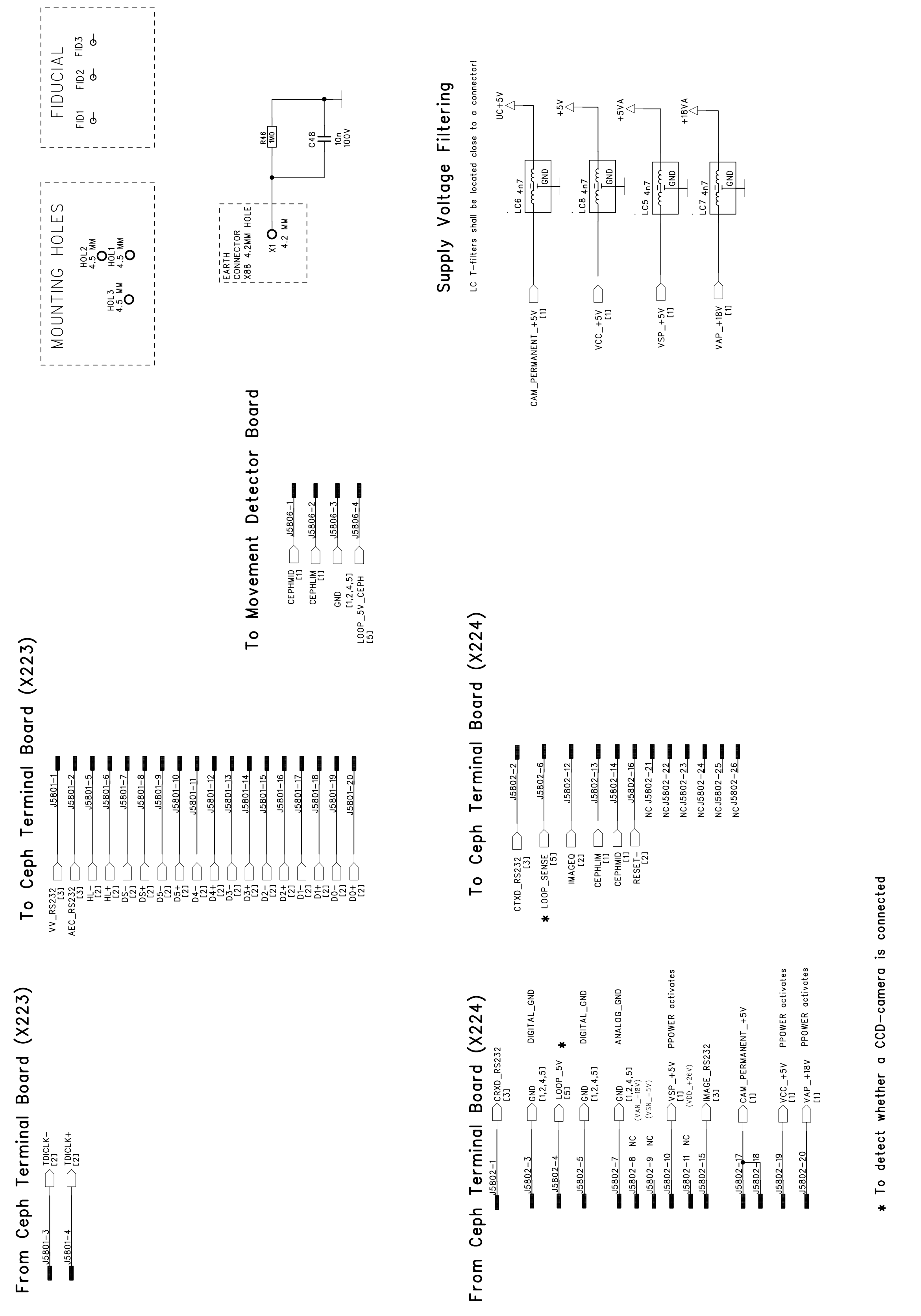
N5800 Connectors

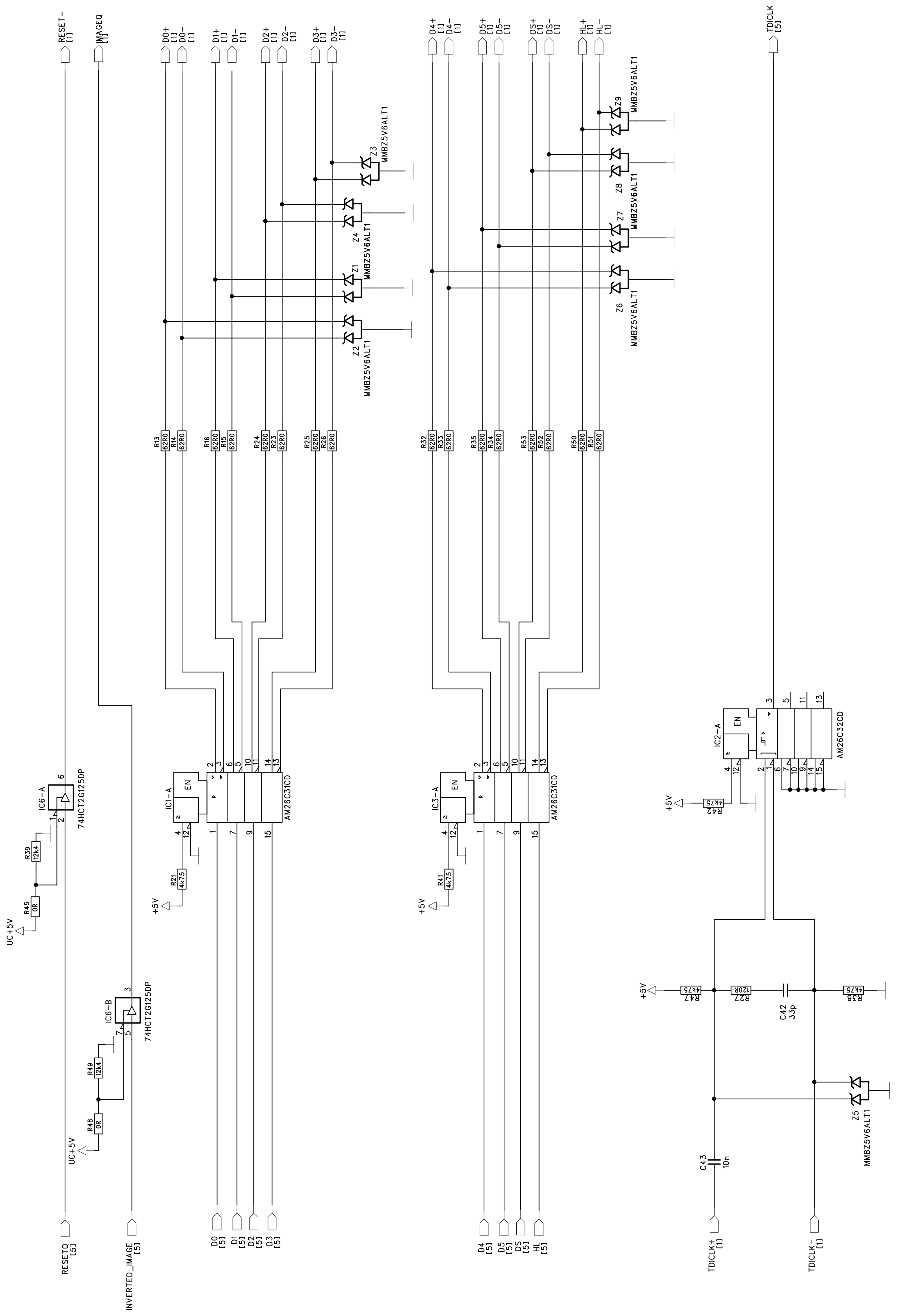
Connector J5801

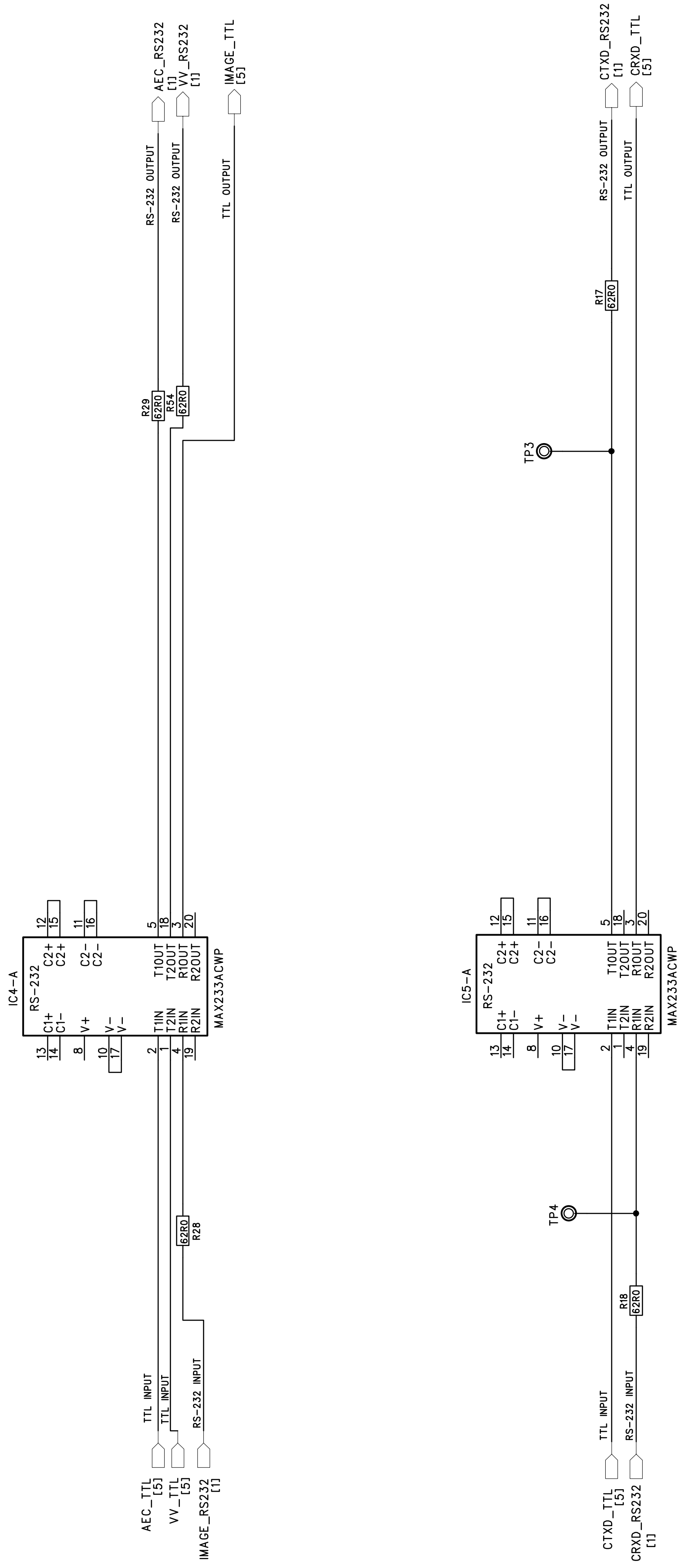
Pin	Signal	Description
1	VV_RS232	VV, RS 232 level
2	AEC_RS232	AEC, RS 232 level
3	TDICLK-	
4	TDICLK+	
5	HL-	HL-signal, differential mode
6	HL+	
7	DS-	DS-signal, differential mode
8	DS+	
9	D5-	D5-signal, differential mode
10	D5+	
11	D4-	D4-signal, differential mode
12	D4+	
13	D3-	D3-signal, differential mode
14	D3+	
15	D2-	D2-signal, differential mode
16	D2+	
17	D1-	D1-signal, differential mode
18	D1+	
19	D0-	D0-signal, differential mode
20	D0+	

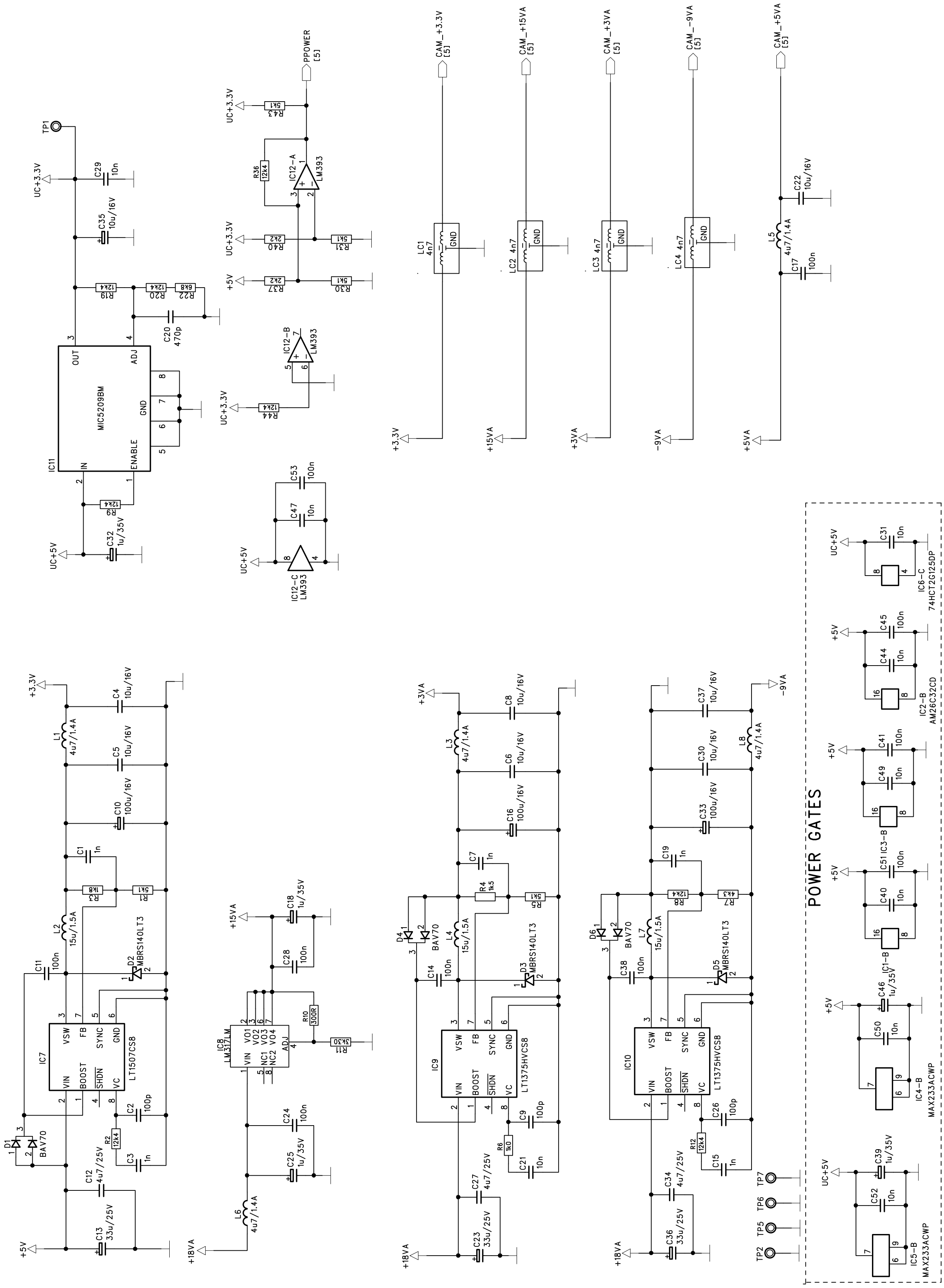
Connector J5802

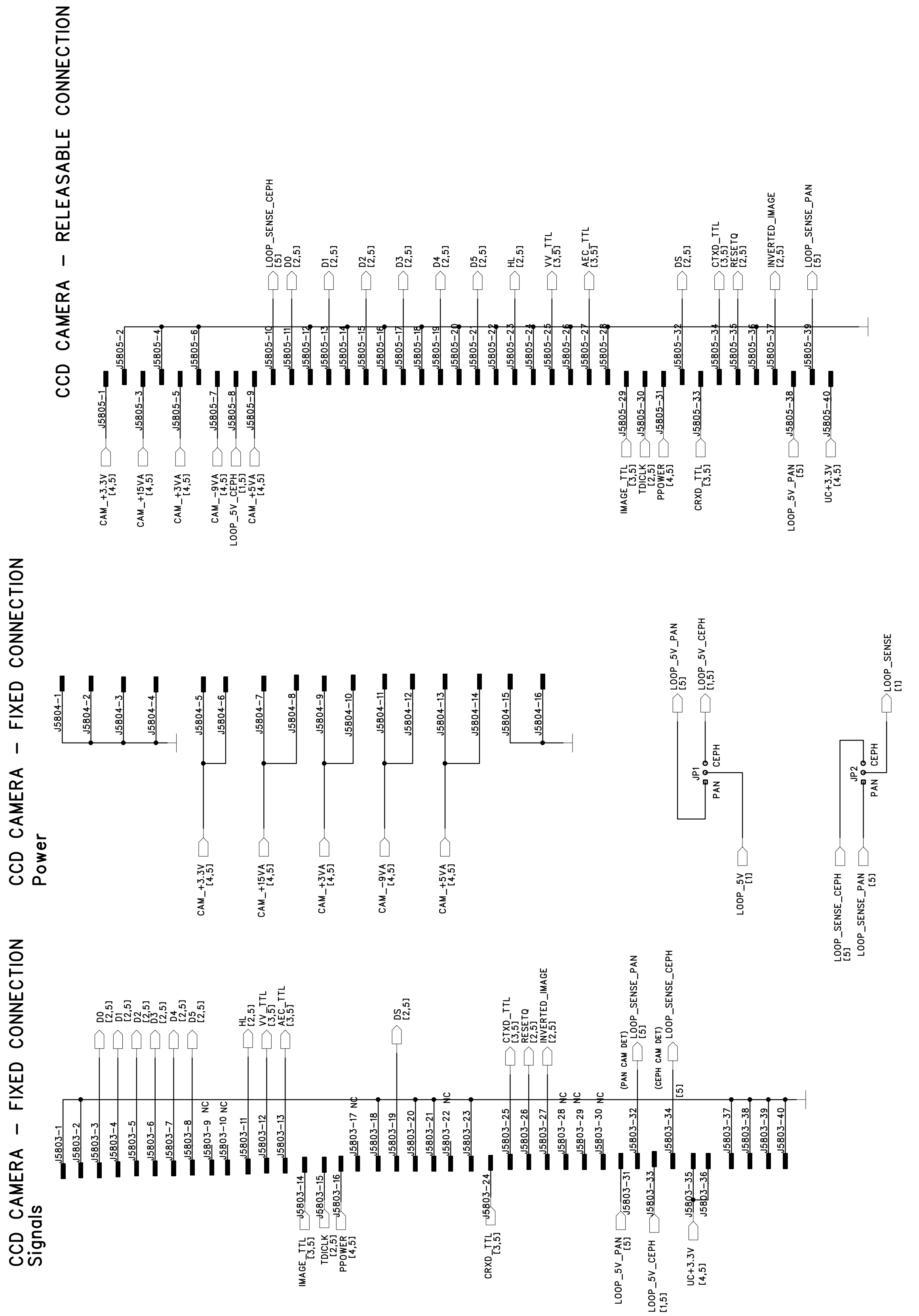
Pin	Signal	Description
1	CR_RS232	RXD signal, RS 232 level
2	CT_RS232	TXD signal, RS 232 level
3	GND	Ground
4	LOOP_5V	
5	GND	Ground
6	LOOP_SENSE	
7	GND	Ground
8	-	Not used
9	-	Not used
10	VSP_+5V	Power supply voltage (CCD)
11	-	Not used
12	IMAGEQ	
13	CEPHLIM	
14	CEPHMID	
15	IMAGE_RS232	Image data RS 232 level
16	RESET	
17	CAM_PERMANENT_+5V	
18	CAM_PERMANENT_+5V	
19	VCC_+5V	Power supply voltage (CCD)
20	VAP_+18V	Power supply voltage (CCD)
21-26	-	Not used

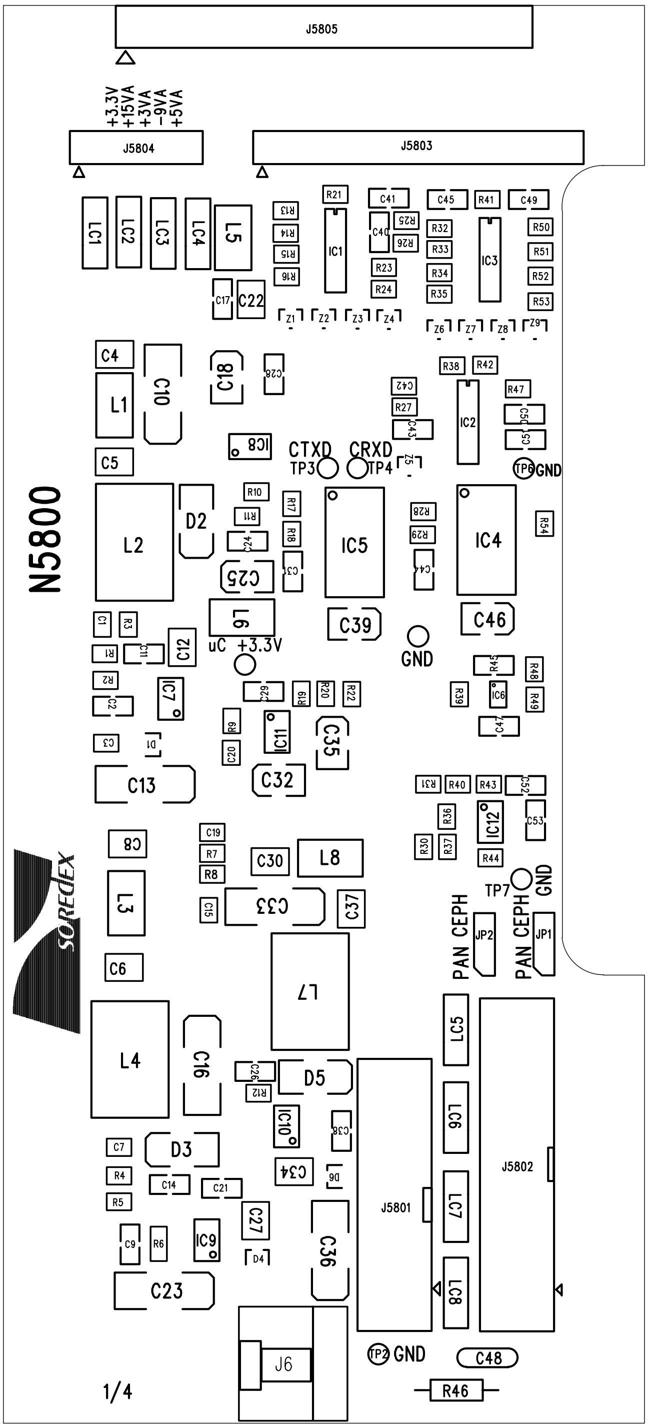

FIDUCIAL
MOUNTING HOLES
EARTH CONNECTOR X88 4.2MM HOLE
Supply Voltage Filtering
LC T-filters shall be located close to a connector!
To Movement Detector Board
To Ceph Terminal Board (X223)
From Ceph Terminal Board (X223)
To Ceph Terminal Board (X224)
From Ceph Terminal Board (X224)
* To detect whether a CCD-camera is connected


RESET-
IMAGEQ
D0+
D0-
D1+
D1-
D2+
D2-
D3+
D3-
D4+
D4-
D5+
D5-
DS+
DS-
HL+
HL-
TDICLK
MMBZ5V6ALT1
IC1-A
AM26C31CD
IC3-A
AM26C31CD
IC2-A
AM26C32CD
IC6-A
74HCT2G125DP
IC6-B
74HCT2G125DP
UC+5V
+5V
C42
33p
C43
10n
RESETQ
INVERTED_IMAGE
D0
D1
D2
D3
D4
D5
DS
HL
TDICLK+
TDICLK-


AEC_RS232 [1]
VV_RS232 [1]
IMAGE_TTL [5]
CTXD_RS232 [1]
CRXD_TTL [5]
RS-232 OUTPUT
TTL OUTPUT
R29 62R0
R54 62R0
R17 62R0
TP3
TP4
IC4-A
IC5-A
RS-232
MAX233ACWP
C1+
C1-
C2+
C2-
V+
V-
T1OUT
T2OUT
R1OUT
R2OUT
T1IN
T2IN
R1IN
R2IN
R28 62R0
R18 62R0
TTL INPUT
RS-232 INPUT
AEC_TTL [5]
VV_TTL [5]
IMAGE_RS232 [1]
CTXD_TTL [5]
CRXD_RS232 [1]


POWER GATES
MIC5209BM
LT1507CS8
LM317LM
LT1375HVCS8
LM393
74HCT2G125DP
AM26C32CD
MAX233ACWP
PPOWER
CAM_+3.3V
CAM_+15VA
CAM_+3VA
CAM_-9VA
CAM_+5VA


CCD CAMERA - RELEASABLE CONNECTION
CCD CAMERA - FIXED CONNECTION
Power
CCD CAMERA - FIXED CONNECTION
Signals



N5900(1) / N5905 Terminal board

N5900 / N5905 - unit versions s/n **B81642 and earlier**.
N5901 / N5905 - unit versions s/n **B91643 and later**.
IMPORTANT NOTE:
N5900 and N5901 are NOT interchangeable.

N5900(1) / N5905 Location

Inside the rotating unit (N5900, N5901).
To access remove the CCD sensor cover and the inner, lower cover from sensor side.
On the ceph head (N5905).
To access remove the ceph head cover.

N5900(1) / N5905 Field replaceable parts

EPROM can be upgraded.
For N5900, eprom version T1 is for the panoramic programs
For N5901, eprom version T1 V1.4 is for the panoramic programs
For N5905, eprom version T2 is for cephalometric programs.

N5900(1) / N5905 Description

Two identical boards except for the flash eprom.
This board serves as a bridge between the optical (towards the PC) and electrical communications. It sends control messages from the PCI Board to the CPU Board and the CCD sensor according to the address. The board combines control data (from the CPU and the CCD sensor) with the image data from the CCD sensor and then sends this information to the PC via PCI Board. The RS422 and RS232 voltage level shifts. Signals PPOWER, PIMAGE, PDETCLK (from the CPU) control image acquisition.

Adjusting the frequency of the ceph nasion support

Use **service program Sr 14 FrE** to check the frequency of the ceph nasion support.
The frequency can be adjusted using a frequency meter as follows:
Connect the probes of a frequency meter to the Ceph Terminal board test points TP52 (NASIO FRQ) and TP60 (GND). Slide the nasion support as far out as possible (away from the ear posts). Adjust trimmer R109 until you get a reading of 3.4 kHZ (25 Hz) on the frequency meter. Slide the nasion support in as far as it will go (towards the ear posts). Adjust trimmer R146 the until you get a reading of 0.7 kHz (24 Hz) on the frequency meter. Check the readings again and repeat the adjustment if necessary.

N5900(1) / N5905 Indicator LEDs

LED	Colour	Description
H1	green	PLD Core +2.5V
H2	green	PLD I/O +3.3V
H3	red	EPROM Failure
H4	green	CAM +5V
H5	green	IMAGE
H6	green	+5V
H7	green	Link OK
H8	red	Reset
H9	green	Nasio reference voltage +2V

N5900(1) / N5905 Test points

TP	Signal	Description
TP1	TXD_TO_CAM_TTL	Transmit Data to Sensor(TTL)
TP2	CAM +5V	
TP3	+6.1V	
TP4	CAM_SHDN-	Sensor Shutdown
TP5	TDI	TDI clock
TP6	GND	
TP7	PLD CORE	+2.5V
TP8	+5V	
TP9	PLD IO	+3.3V
TP10	SPARE2	
TP11	SPARE1	
TP12	CCD_POWER-	CPOWER, activates voltage sources for the CCD
TP13	AEC_FRQ	
TP25	+2V	Nasio pot +2V ref voltage
TP26	LOOP_5V	Used to recognize if there is a CCD sensor
TP27	LOOP_SENSE	attached (both LOOPs)
TP28	SPARE3	
TP29	+5V	
TP32	CAM_RXD2	
TP33	CAM_RXD1	
TP34	VV-	Valid video
TP35	IMAGEQ	Inv. IMAGE-signal
TP36	SS-	
TP37	H/L-	High/Low- byte
TP38	DS	Data Strobe
TP39	IMAGE5	Image Data Signal 5
TP40	IMAGE4	Image Data Signal 4
TP41	IMAGE3	Image Data Signal 3
TP42	IMAGE2	Image Data Signal 2
TP43	VCC(RXD)	
TP44	ECLIN-	
TP45	ECLIN	
TP46	COPPER_TEST+	
TP46	COPPER_TEST-	
TP50	VCC (ECL-TTL)	
TP51	EN_NASIO_FRQ	Enable Nasio Frequency
TP52	NASIO_FRQ	Nasio Frequency
TP54	IMAGE1	Image Data Signal 1
TP55	IMAGE0	Image Data Signal 0
TP56	VCC(TXD)	
TP57	+1V	Nasio pot +1V ref voltage
TP58	NASIO_POSITION_SLIDE	Nasion position
TP59	+2V	Nasio pot +2V ref voltage
TP60	GND	-

N5900(1) / N5905 Connectors

Connector X223

Pin	Signal	Description
1	VV_RS232	VV, RS 232 level
2	AEC_RS232	AEC, RS 232 level
3	TDICLK-	
4	TDICLK+	
5	HL-	HL-signal, differential mode
6	HL+	
7	DS-	
8	DS+	
9	D5-	
10	D5+	
11	D4-	
12	D4+	
13	D3-	
14	D3+	
15	D2-	
16	D2+	
17	D1-	
18	D1+	
19	D0-	
20	D0+	

Connector X224

Pin	Signal	Description
1	CRDX_RS232	
2	CTDX_RS232	
3	GND	Ground
4	LOOP_5V	
5	GND	Ground
6	LOOP_SENSE	
7	GND	Ground
8	-	Not used
9	-	Not used
10	VSP_+5V	Power supply voltage (CCD)
11	-	Not used
12	IMAGEQ	
13	-	Not used
14	-	Not used
15	KVOK	
16	MAOK	
17	CAM_PERMANENT_+5V	
18	CAM_PERMANENT_+5V	
19	VCC_+5V	Power supply voltage (CCD)
20	VAP_+18V	Power supply voltage (CCD)
21-26	-	Not used

Connector X225

Pin	Signal	Description
1-2	Not used	
3	VSP_+5V	Power supply voltage (CCD)
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	VAP_+18V	Power supply voltage (CCD)
11	VCC_+5V	Power supply voltage (CCD)
12	-	Not used
13	+5.7V	Power supply voltage (CCD)
14	+5.7V	Power supply voltage (CCD)

Connector X226

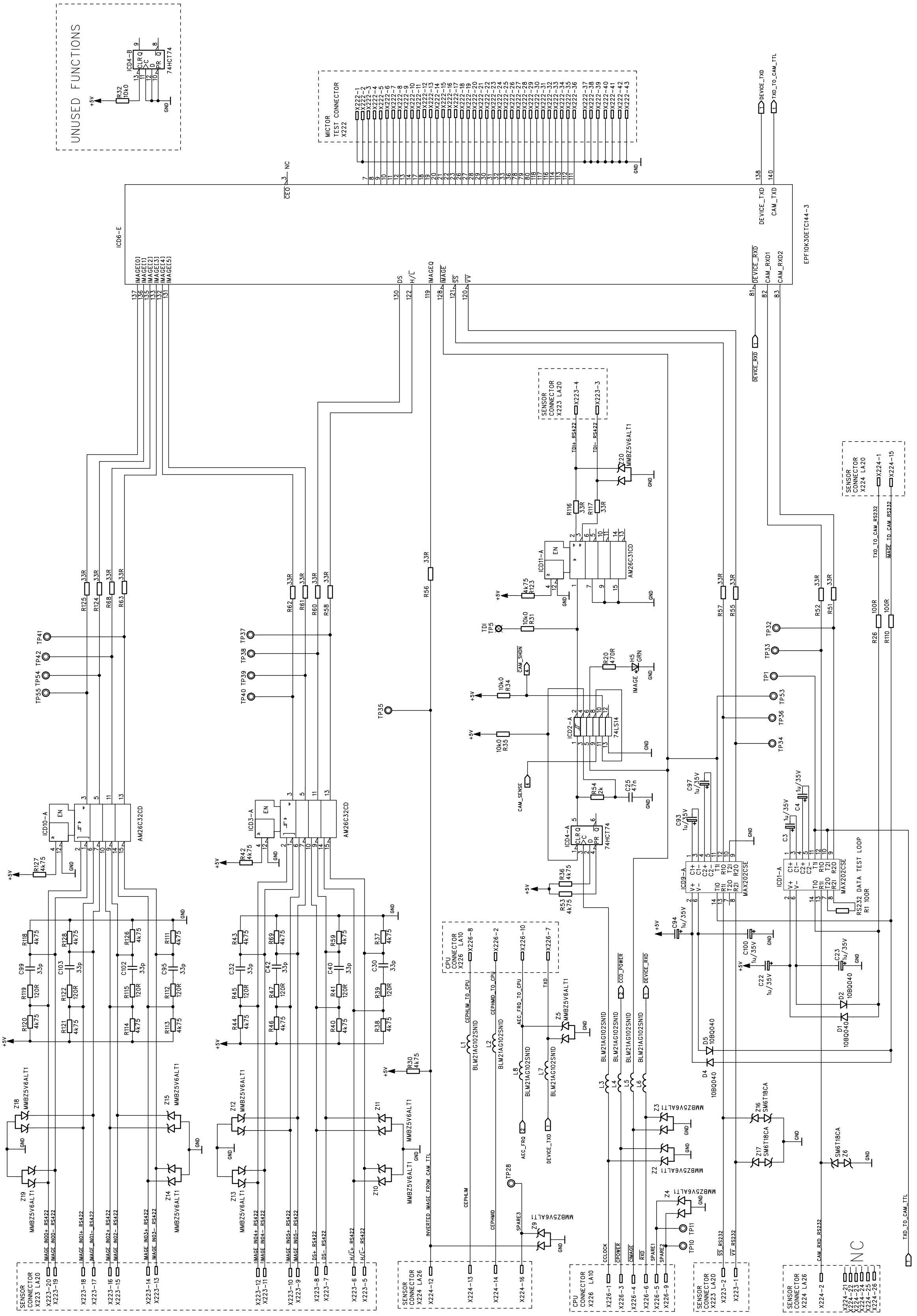
Pin	Signal	Description
1	PDETCLK	CCD detector clock
2	Not used	
3	PPOWER-	Pan-ccd power enable
4	PIMAGE-	Pan-ccd image enable
5	NC	Not used
6	RDX2	Receive data signal
7	TXD2	Transmit data signal
8	Not used	
9	Not used	
10	AEC_FRQ_TO_CPU	Frequency line to CPU

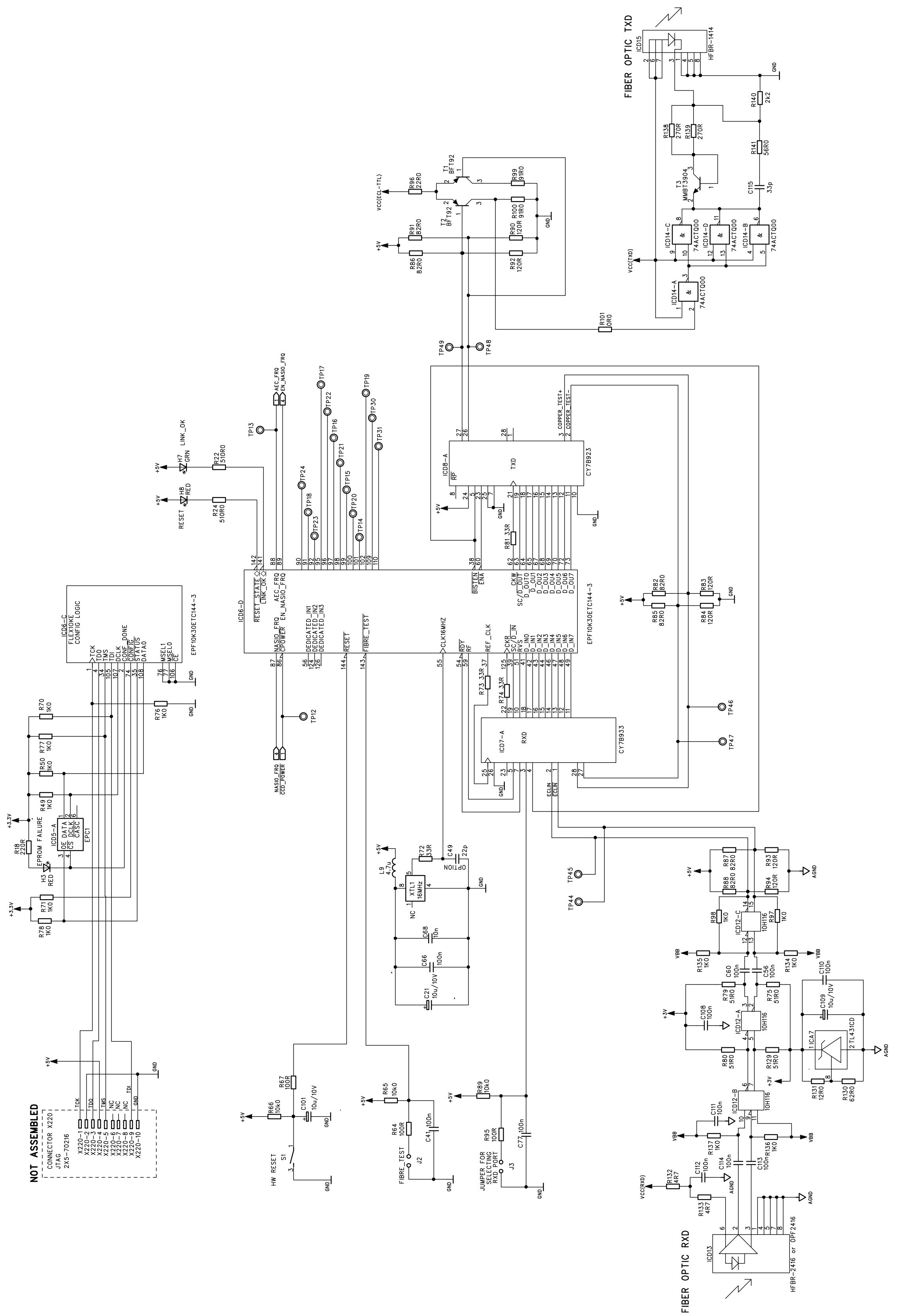
ICD13	Fiber obtic RXD
ICD15	Fiber obtic TXD

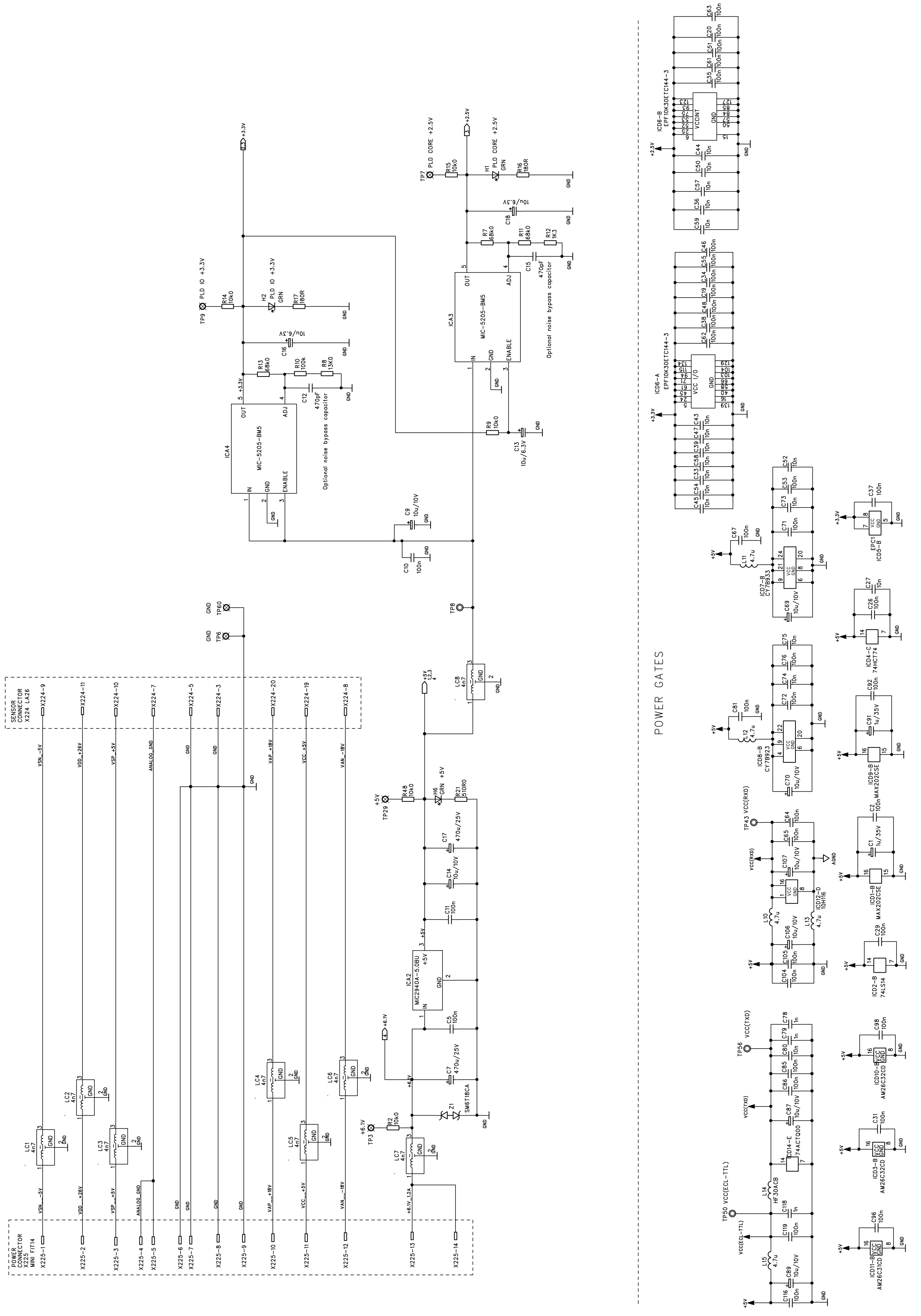
Only N5905 Ceph

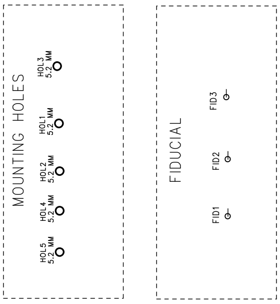
Connector X221

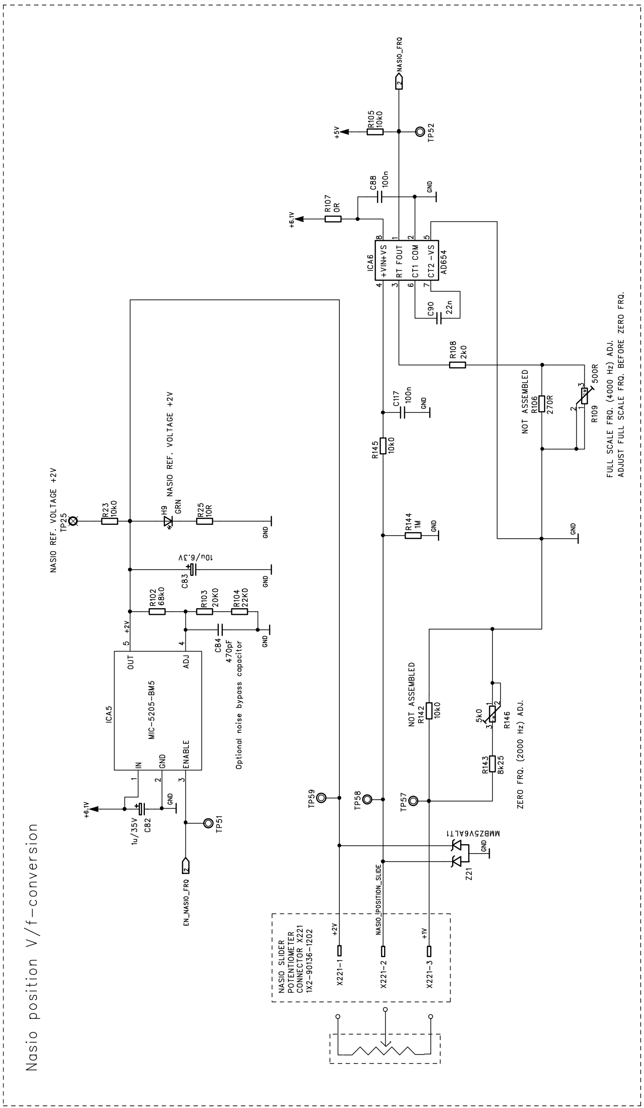
Pin	Signal
1	+2V
2	POT.SLIDE
3	+1V

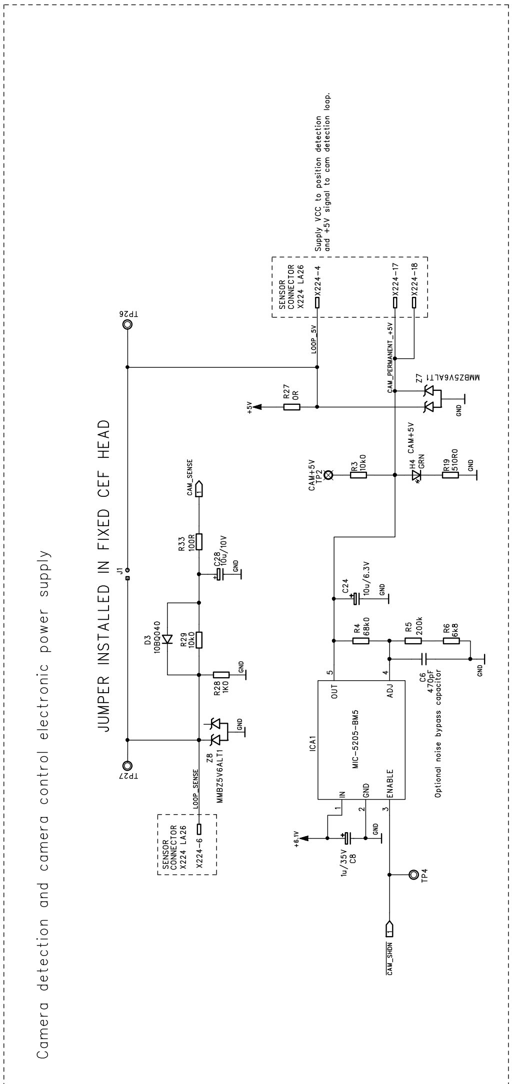

UNUSED FUNCTIONS
MICTOR TEST CONNECTOR X222
EPF10K30ETC144-3
AM26C32CD
AM26C31CD
74LS14
74HCT74
MAX202CSE
RS232 DATA TEST LOOP

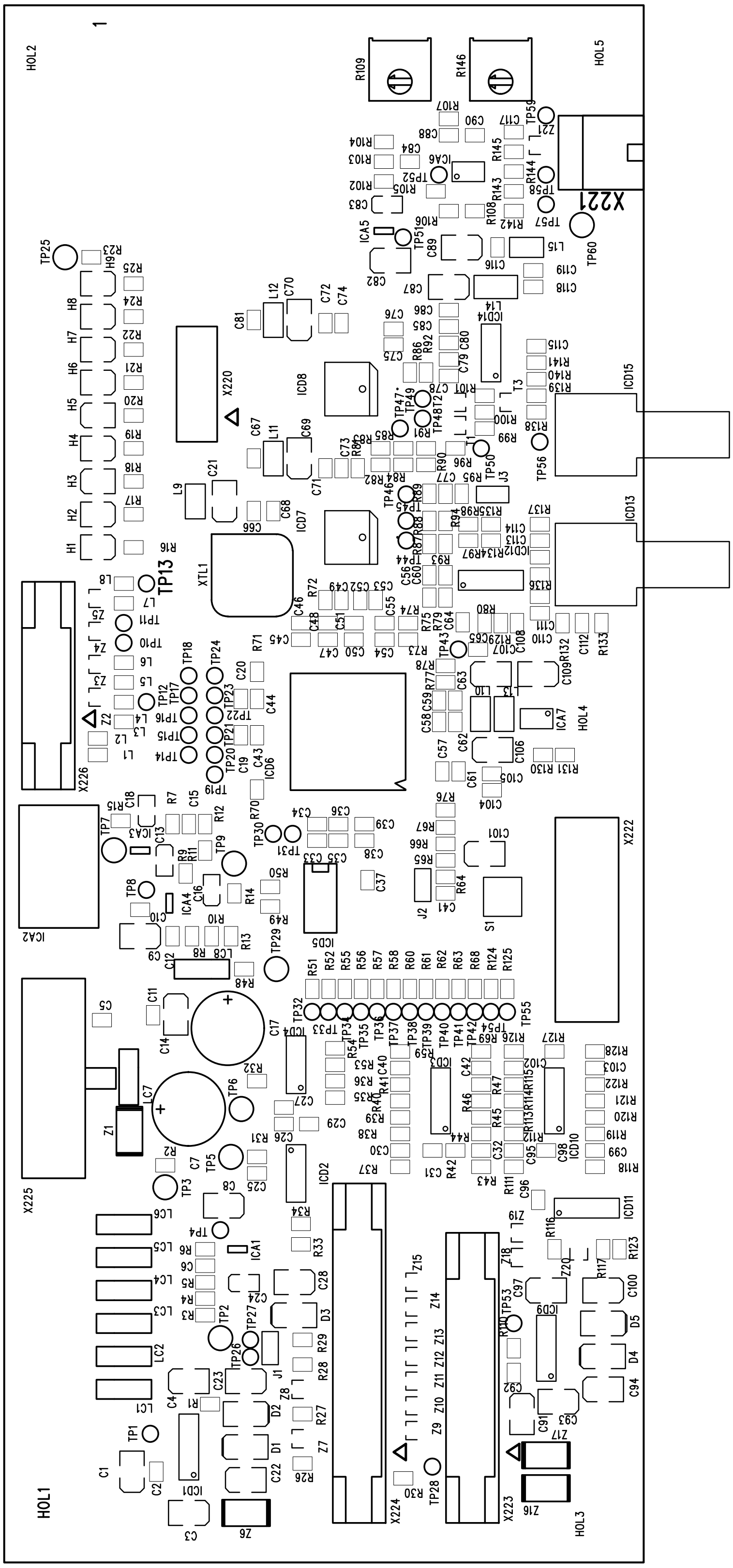

FIBER OPTIC TXD
FIBER OPTIC RXD
NOT ASSEMBLED


POWER GATES
Optional noise bypass capacitor
Optional noise bypass capacitor


MOUNTING HOLES
FIDUCIAL


Nasio position V/f-conversion


Camera detection and camera control electronic power supply
JUMPER INSTALLED IN FIXED CEF HEAD



N6000 Ceph Head board

N6000 Location

On the Cranex D ceph head .
To access remove the ceph head cover.

N6000 Field replaceable parts

None

N6000 Description

This board includes the stepper motor controller for the ceph motor to allow CEPH imaging movements. It also supplies power to the CCD sensor when it is attached to the ceph head.

N6000 Jumpers

J1	OFF in normal use, ON enables exposure without Beam Alignment Board (it ignores the CEPHC-signal) for service purposes.

N6000 Indicator LEDs

LED	Colour	Description
H1	green	+34V(permanent)
H2	red	SCAN1
H3	red	SCAN2
H4	red	+5V (permanent)
H5	red	SCAN3
H6	red	5SCAN4
H7	green	+18V (VAP)
H8	green	-5V (VSN)
H9	green	+26V (VDD)
H10	green	+5 (VPS)
H11	green	+6.1V (permanent)
H12	green	-18V (VAN)
H13	green	+5V (VCC)

N6000 Test points

TP	Signal	Description
TP1	CLASLIT-	Enables head size measurement
TP3	CEPHDIR-	Cephalo stepper motor diection
TP6	CEPHLIM-	Cephalo movement sensor
TP7	GND(CPU)	-
TP8	CAECFRQ	Cephalo Frequency
TP9	CEPHMID-	Cephalo movement sensor
TP10	CPU_RXD	Serial communication
TP11	+5V	(CPU)
TP12	CPROJTRIG-	
TP15	LAT/PA-	Head support in Lat or PA
TP17	+34V	Supply voltage +34V
TP18	CPOWER-	Enables power for the CCD sensor
TP20	CEPHDOWN-	
TP21	CCLOCK	TDI clock for the ceph detector
TP22	IMAGE-	Enables the CCD outputs
TP23	CEPHUP-	
TP24	GND	
TP25	CPROGTRIG_	SW-
TP26	GND	
TP27	+5V	
TP28	VAP	+18V Analog +18VDC (CCD sensor)
TP29	VSN –5V	Not used
TP30	VDD +26V	Not used
TP31	GND	-
TP32	VSP +5V	Analog +5VDC (CCD detector)
TP33	+6.1V	Used in N5900 for supply voltages
TP34	VAN –18V	Not used
TP35	GND	-
TP36	VCC +5V	Digital +5VDC (CCD detector)

N6000 Connectors

Connector X231

Pin	Signal	Description
1-2	Not used	
3	VSP_+5V	Power supply voltage (CCD)
4	GND	Ground
5	GND	Ground
6	GND	Ground
7	GND	Ground
8	GND	Ground
9	GND	Ground
10	VAP_+18V	Power supply voltage (CCD)
11	VCC_+5V	Power supply voltage (CCD)
12	-	Not used
13	+5.7V	Power supply voltage (CCD)
14	+5.7V	Power supply voltage (CCD)

Connector X232

Pin	Signal	Description
1	PDETCLK	CCD detector clock
2	Not used	
3	PPOWER-	Pan-ccd power enable
4	PIMAGE-	Pan-ccd image enable
5	NC	Not used
6	RDX2	Receive data signal
7	TXD2	Transmit data signal
8	Not used	
9	Not used	
10	AEC_FRQ_TO_CPU	Frequency line to CPU

Connector X233

Pin	Signal	Description
1	VSN_-5V	Power supply
2	GND	Ground
3	VSP_+5V	Power supply
4	GND	Ground
5	+5V	Not used
6	LASER_ON	Not used
7	CEPHL_	Left
8	CEPHC_	Central
9	CEPHR_	Right
10	GND	Ground

Connector X236

Pin	Signal	Description
1	+5V	Power supply voltage
2	GND	Ground
3	LAT-/PA	Lateral or PA image in cephalo
4	CEPHROK-	
5	CEPHCOK-	Ceph cassette sensor
6	CEPHLOK-	
7	CEPHMIDSW	Ceph movement sensor
8	CEPHLIMSW	Ceph movement sensor
9	CEPENA	Ceph stepper motor drive enable
10	CEPHDIR	Ceph stepper motor drive direction
11	-	Not used
12	CPPROJTRIG-	
13	FILT5	
14	CAECRFRQ	Ceph (nasion/head size) frequency
15	-	Not used
16	-	Not used
17	CEPHUP-	Z movement up
18	CEPHDOWN-	Z movement down
19	+5V	Power supply voltage
20	GND	Ground
21	CPOWER-	Ceph-CCD power active
22	CIMAGE-	Ceph-CCD image active
23	CEPHCLK	Ceph stepper motor clock
24	CDETCLK	CCD detector clock
25	CLASLIT	Enables head size measurement
26	GND	Ground

Connector X237

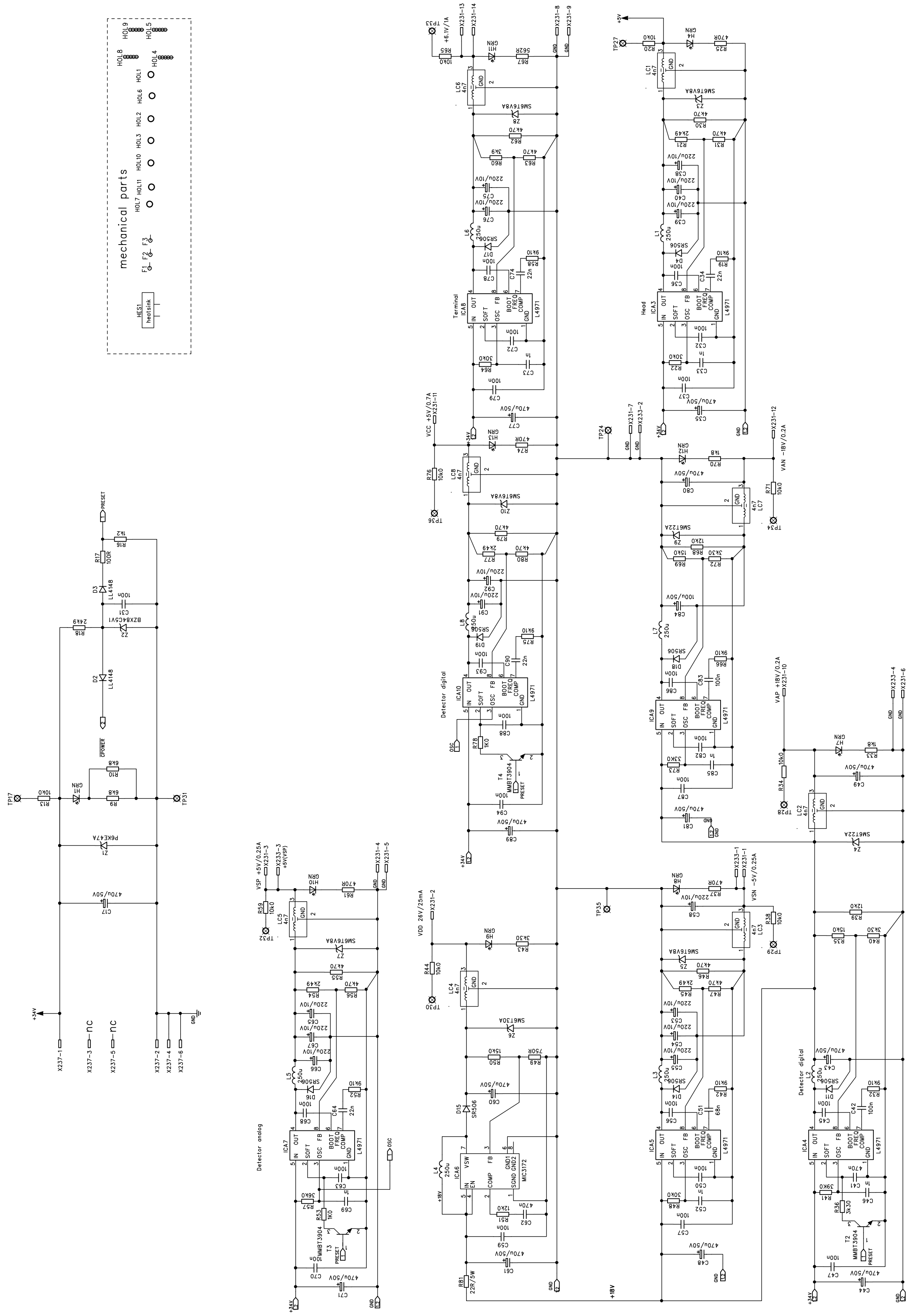
Pin	Signal	Description
1	+34V	Power supply voltage
2	GND	Ground
3	-	Not used
4	GND	Ground
5	-	Not used
6	GND	Ground

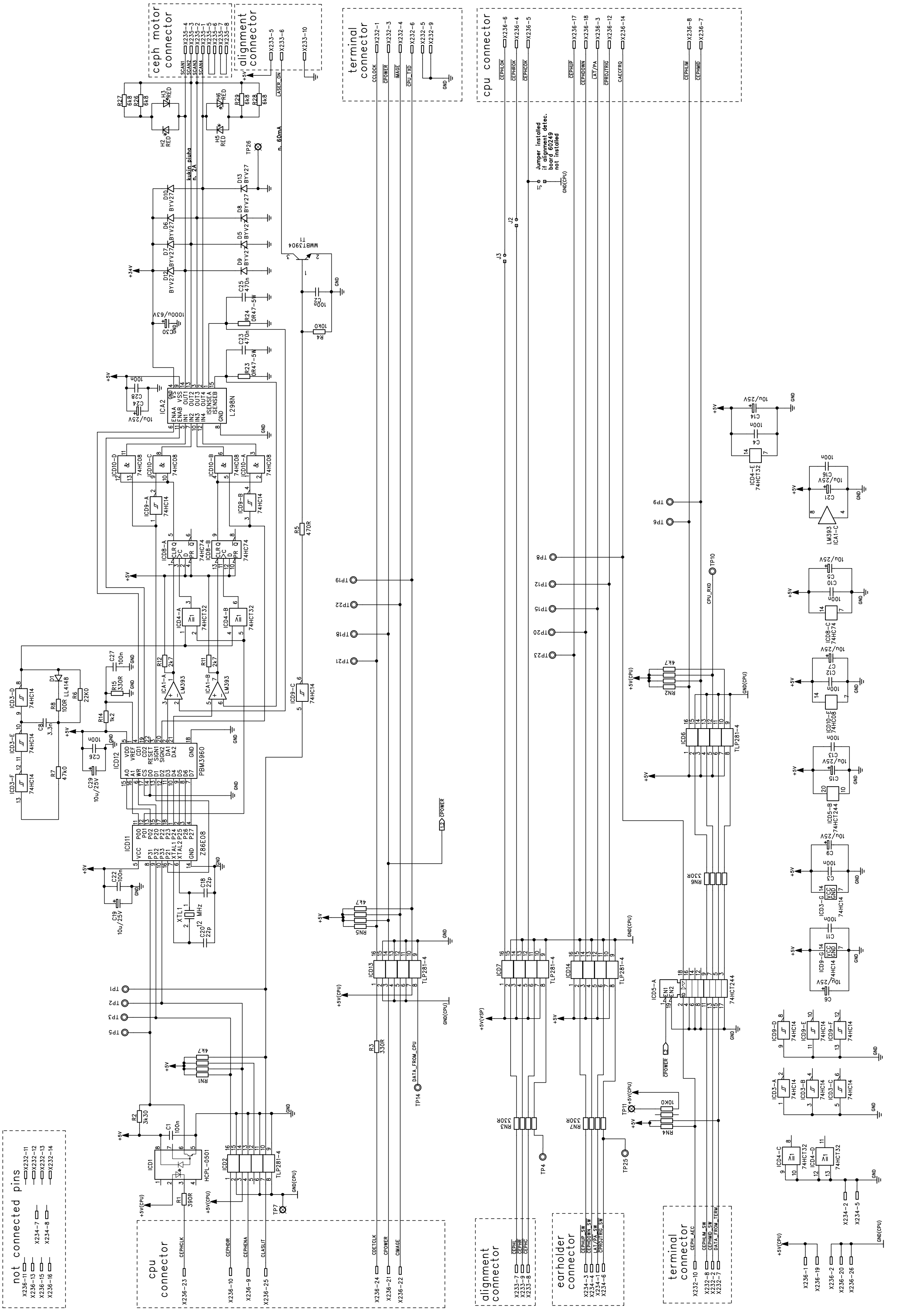
Connector X234

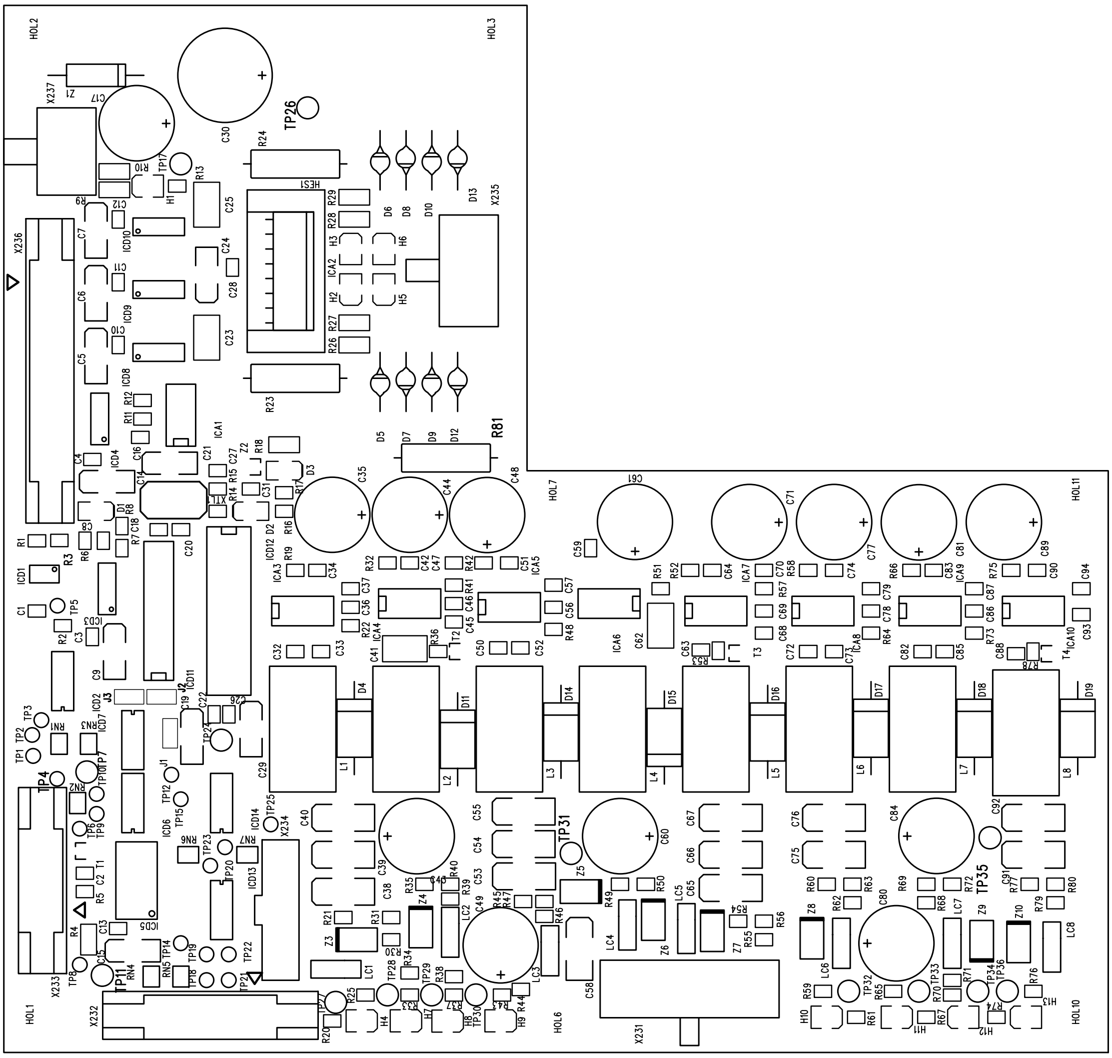
Pin	Signal
1	Lat/PA-_SW
2	GND
3	CEPHUP_SW_
4	CEPHDOWN_SW_
5	GND
6	CPPROJTRIG_SW_
7	-
8	-

Connector X235

Pin	Signal
1	Stepper1
2	Stepper2
3	Stepper3
4	Stepper4







N6100 Beam Alignment board

N6100 Location

In the ceph head on ceph aperture.
To access remove the ceph aperture covers.

N6100 Field replaceable parts

None

N6100 Description

The alignment of the CEPH x-ray beam is controlled by the main CPU throughout the exposure. The position of the CEPH X-ray beam in relation to the secondary collimator is monitored by the Beam Alignment board that uses three detection channels (CEPHL, CEPHR& CEPHC). If either the CEPHL or CEPHR -signal becomes active the main CPU accelerates or decelerates the rotation and linear movements, i.e. the movement of the X-ray beam. If CEPHC -signal becomes passive the exposure is terminated (CbA, Alignment error).

Beam Alignment Monitoring - Sensitivity Adjustment

1. Make sure that radiation beam is positioned so that it strikes in the middle of secondary slot.
2. Press the RETURN-key to drive the unit to the ceph PIO position (secondary slot and the CCD-sensor are in the "middle" position).
   If the ceph head does not go to the PIO position first press the RETURN-key in PAN mode and then select the CEPH mode and press the RETURN-key again.
3. Take exposures in the EPS mode at 57kV/2mA and adjust the center channel (CEPHC) sensitivity using trimmer R10 on the N6100 board so that it detects radiation, LED H2 will come on. Turn trimmer R10 counter-clockwise (CCW) to increase the sensitivity and clockwise (CW) to decrease the sensitivity.
   In Germany and other countries where the prufkörper test method is used, use 0.8 mm copper filtration and 85kV/8mA instead of the values stated above.

4. Move the Ceph secondary collimator by hand (use the cogged belt) so that it moves 10mm to the left from the PIO position. Adjust the right channel (CEPHR) sensitivity using trimmer R16 on the N6100 board until LED H3 comes on. Use the EPS mode 60kV/2.5mA.

5. Move the Ceph secondary collimator by hand (use the cogged belt) so that it moves 10mm to the right from PIO position. Adjust the left channel (CEPHL) sensitivity using trimmer R4 until LED H1 comes on. Use the EPS mode 60kV/2.5mA.
NOTE! Normally during steps 3-5 only one LED at time will come on. Decrease sensitivities so that conditions in 3-5 are met.

N6100 Indicator LEDs

LED	**Colour**	**Description**
LED	Colour	Description
H1	Green	CEPHL
H2	Green	CEPHC
H3	Green	CEPHR
H4	Green	+5V

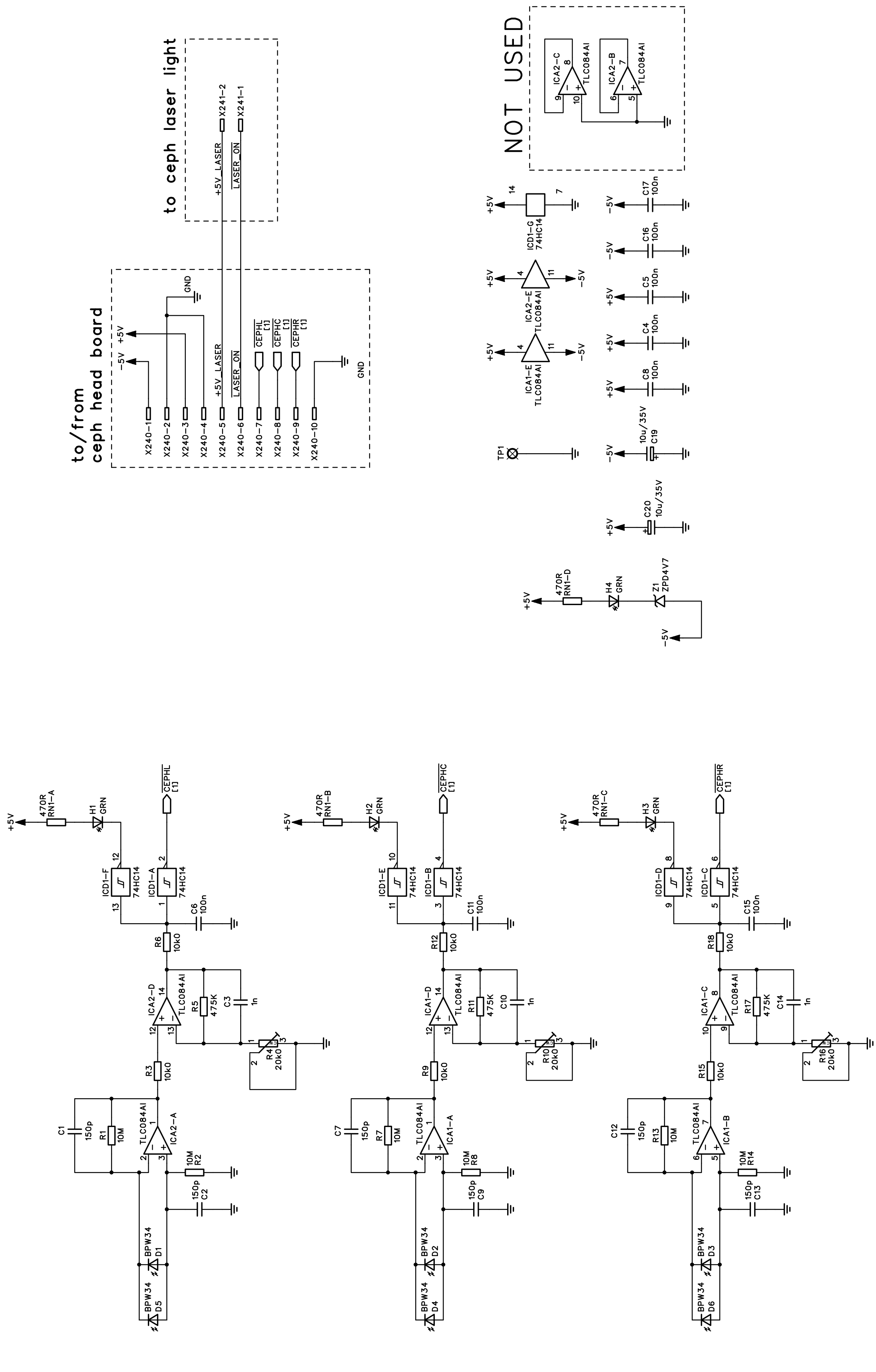
N6100 Test points

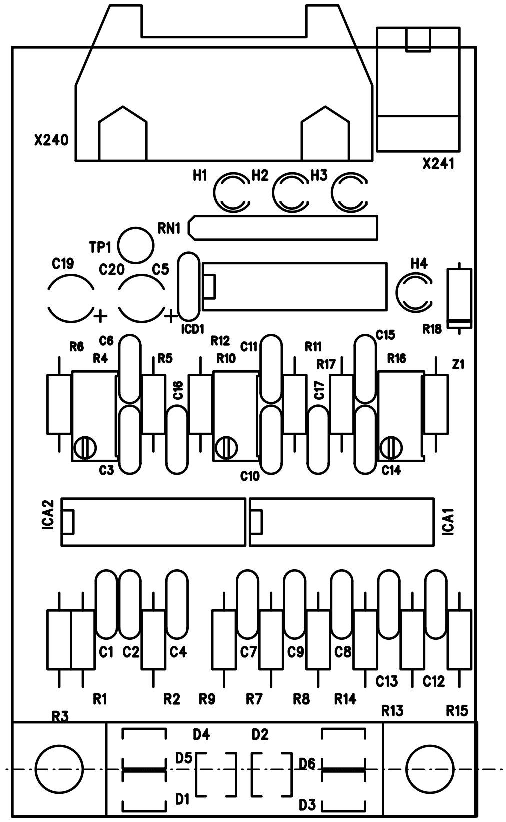
None

N6100 Connectors

Connector X240

Pin	Signal	Description
1	VSN_-5V	Power supply
2	GND	Ground
3	VSP_+5V	Power supply
4	GND	Ground
5	+5V	Not used
6	LASER_ON	Not used
7	CEPHL_	Left
8	CEPHC_	Central
9	CEPHR_	Right
10	GND	Ground


to ceph laser light
to/from ceph head board
NOT USED


X240
X241
H1
H2
H3
RN1
TP1
C19
C20
C5
H4
ICD1
R18
R6
C6
R4
R5
R12
R10
C11
R11
R17
C15
R16
Z1
C16
C17
C3
C10
C14
ICA2
ICA1
C1
C2
C4
C7
C9
C8
C13
C12
R1
R2
R9
R7
R8
R14
R13
R15
R3
D4
D2
D5
D6
D1
D3

N6200 Movement Detect board

N6200 Location

In the ceph head.
To access remove the ceph head cover.

N6200 Field replaceable parts

None

N6200 Description

The N6200 board includes optosensors that are used to detect the position of the Ceph movement. The signals from the two sensors are CEPHLIMSW and CEPHMIDSW .
Each optosensor comprises a transmitter LED, and a receiver, or base. The sensor signal remains on as long as the base receives light from the LED. If the light beam to the base is cut off, for example, by the positioning rail, the sensor signal is switched off.

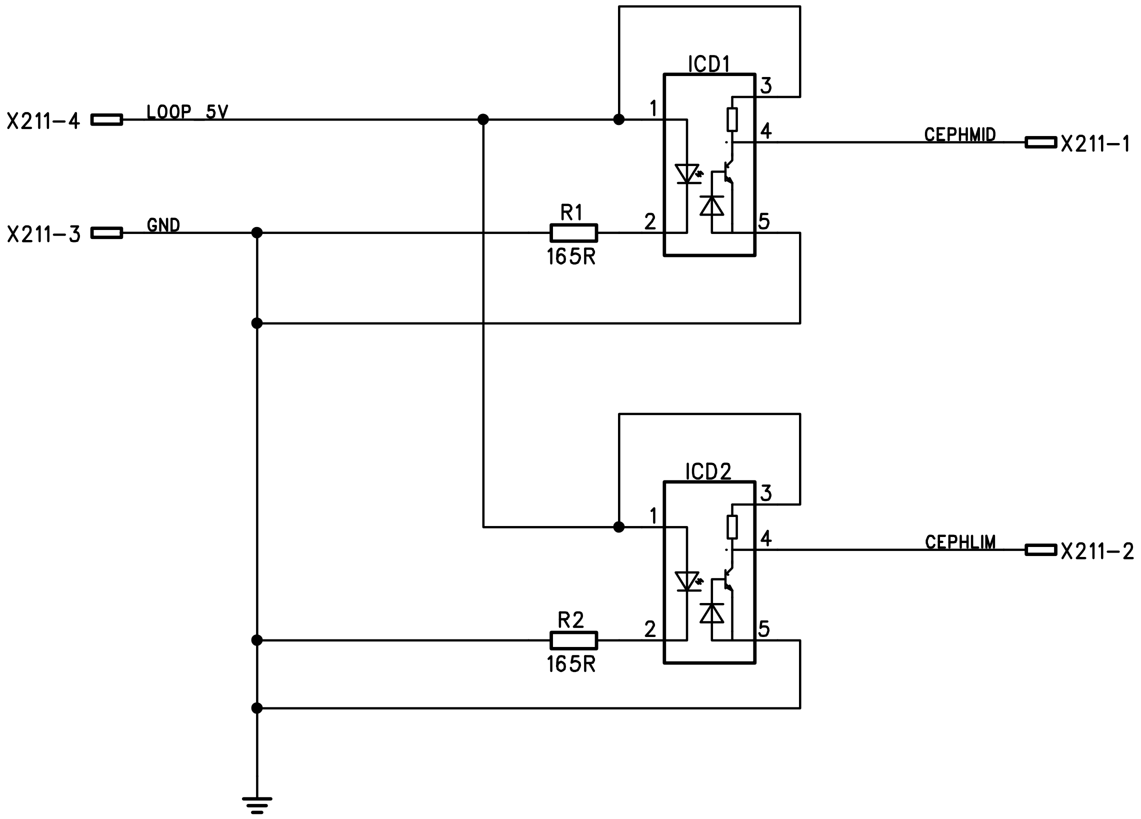
N6200 Indicator LEDs/ Test points

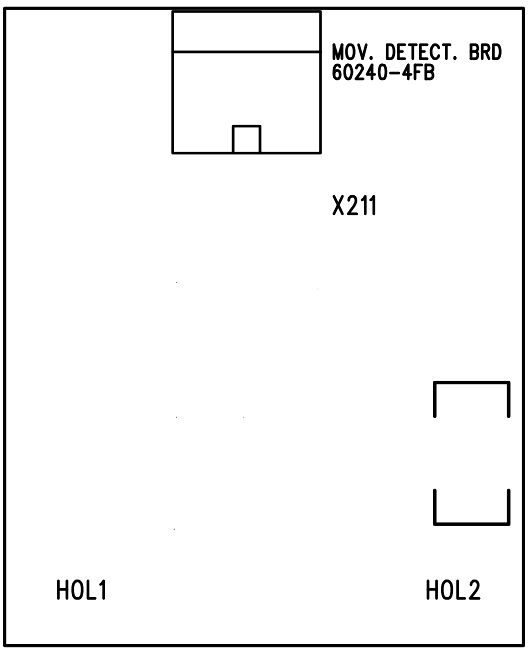
None

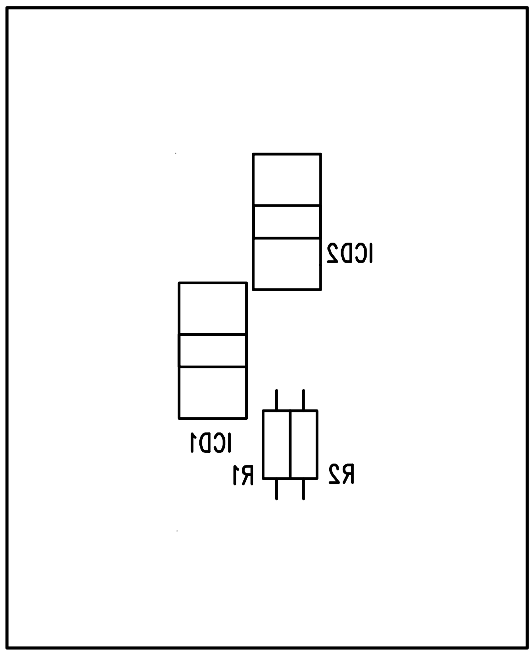
N6200 Connectors

Connector X211

Pin	Signal	Description
1	CEPHPIO	
2	CEPHLIM	
3	GND	
4	LOOP_5V	


X211-4
LOOP 5V
X211-3
GND
ICD1
R1
165R
CEPHMID
X211-1
ICD2
R2
165R
CEPHLIM
X211-2


MOV. DETECT. BRD
60240-4FB
X211
HOL1
HOL2


ICD2
ICD1
R1
R2

7. Error Codes and Trouble Shooting

7.1 Warnings and precautions

Warning - X-rays

When checking and testing the operation of the unit **always** protect yourself from radiation generated by the X-ray tube.

Warning - Electric shock

Switch the unit off and isolate it from the main power supply before handling or replacing any of the circuit boards in the unit.

Warning - High voltage

Before handling or replacing any of the boards switch the unit off, isolate it from the main power supply and wait 10 minutes for the capacitors on these boards to discharge.

Caution - Static discharge

Always take adequate precautions when handling circuit boards to prevent static discharge. Leave all new or replacement circuit boards in their protective packaging until the boards are needed. When handling the boards hold them by their edges and do not touch any connectors or components. Static discharge can destroy board components.

7.2 Trouble shooting principles

Circuit boards

Circuit boards cannot be repaired in the field. If a board is found to be faulty the quickest way to get the unit working again is to replace the faulty board with a new one or one that is known to be working correctly.

Indicator LEDs

On most of the circuit boards there are indicator LEDs. These are described in the section **Circuit Board Description**.

Test pins

On some of the circuit boards there are test pins that allow the board to be checked to see if it is functioning correctly. These are also described in the section **Circuit Board Description**.
When checking voltages a digital multimeter (DMM) must be used.

Checking cables

The procedure for checking the cables is as follows:

1. Make sure that the connectors on the cables are correctly plugged in to their respective connectors on the circuit boards. The connectors must be squarely positioned and must not be loose or crooked. If the connector has a locking mechanism make sure that it is locked.
   If the connector looks out of position, remove the connector, check the pins (see 2, below). If the pins are okay reconnect the connector.

2. Disconnect the connectors from the boards and make sure that there are no bent, broken or missing pins. If there is damage that can be easily repaired, for example straightening a pin, repair the damage and reconnect the connector. If the damage cannot be repaired replace the cable.

3. Visually check the cable for cuts, wear, damaged insulation and kinks. If there is obvious mechanical damage to the cable it must be replaced. If there is no obvious mechanical damage use a digital multimeter (DMM) to check the resistance of the different wires within the cable. An undamaged wire will have no resistance (0 ohm), a damaged wire will have a resistance value.

Bad quality images

Bad quality images can be due to one or more of the following:

- incorrect patient positioning
- a badly aligned unit
- image filtering settings

Incorrect patient positioning

If the unit is producing bad quality images, first make sure that the user is positioning the patient correctly.
For information on how to position the patient refer to the User's Manual.

A badly aligned unit

If patient positioning is correct, check that the alignment of the unit.
For information on how to align the unit refer to the Installation and set-up manual.

Image filtering settings

If patient positioning and unit alignment are correct, refer to section **Image Appearance**.

Power supply problems

Power supply problems are usually due to blown fuse on the power supply board. By checking the status of the indicator lights on the power supply board and verifying the condition of fuses, most power supply problems can be solved. See N4700, Power Supply.

Display problems

If the display remains blank when the unit is switched on it is either because the unit is not receiving power or because there is a problem with the display.

7.3 Error codes and what they mean

The unit selftest

When the unit is switched on, it carries out a selftest. During the test the software the SPI communication, control panel and some circuit boards are tested.
If the unit is functioning correctly software version information will appear briefly on the kV, mA and s display of control panel.

Error codes

Error codes appear on the control panel, for example:

E 13 dor

An error code (or codes) will appear if the unit malfunctions during operation or if the unit is not ready to take an exposure when the exposure button is pressed.
The unit cannot be operated if there is an error message on the display.
Error codes are cleared by pressing the **E** key.
If the error is not corrected, the error code will keep reappearing.

List of error codes

PC1 NC (only on the User's Interface)

CAUSE
X-ray unit not switched on and/or there is no connection between the PC and the Unit.

SOLUTION
Switch the unit on and/or check that the cable between the PC and the UNIT is connected properly.

E2 CAS

PROBLEM
Service jumper connected to N5200 board.

SOLUTION
Remove the service jumper. (The jumper must only be used for service purposes)

E3 CoL (Pan/Ceph units only)

CAUSE
The primary slot has not moved to the correct position. Ceph primary slot has been selected for a panoramic program exposure.

SOLUTION
Check that the collimator motor is functioning correctly.
Check that the optosensors are functioning correctly.

E4 CoL (Pan/Ceph units only)

CAUSE
The primary slot has not moved to the correct position. Panoramic primary slot has been selected for a ceph exposure.

SOLUTION
Check that the collimator motor is functioning correctly.
Check that the optosensors are functioning correctly.

E7 rEL

CAUSE

The exposure button was released during an exposure.

SOLUTION

Operator error.

If the exposure failed while the exposure button was still being pressed, check the exposure switch by taking a test exposure without patient to see if the exposure button is defective or not. If the same problem occurs again, replace the exposure button.

E8 MoE

CAUSE

The exposure button was pressed when one of the Y/Z keys was being pressed.

SOLUTION

Do not press the exposure button while the Y/Z buttons are being pressed.

E9 (*******) (the WAIT time will appear in seconds)

CAUSE

The WAIT time (cooling time between exposures) has not yet elapsed.

SOLUTION

Wait until the WAIT time elapses.

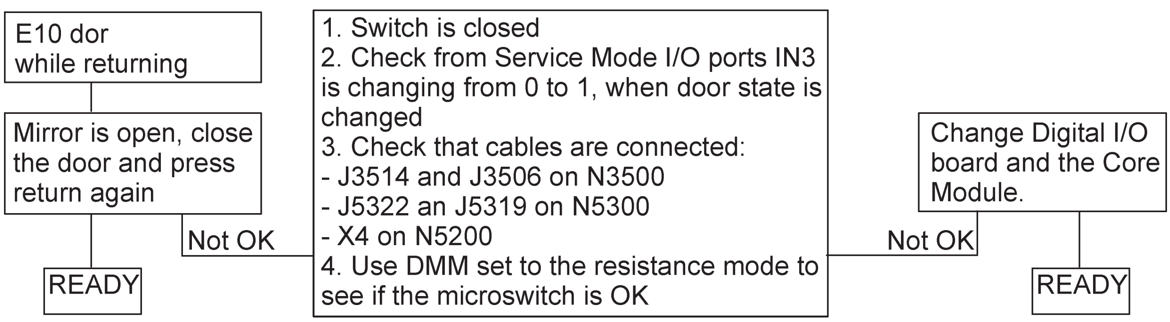
E10 dor

CAUSE

The patient positioning mirror is open.

SOLUTION

Operator error. Close the mirror.



E12 cCo

CAUSE

The primary collimator has not changed to the child panoramic size.

SOLUTION

Press the E key to clear the error message. Then press the RETURN key to drive the unit to the PIO position, and then press the key again to drive it to the START position. If the error message reappears, call service.

NOTE

Exposures of children can be taken with the adult panoramic program. Note ,however, that the height and width of the exposed area is not reduced.

E16 PoS

CAUSE

i. The rotating unit is not in the PIO or START position.

ii The mirror is open.

SOLUTION

i. Press the E key to clear the error and then press the RETURN key to drive the rotating unit to the right position.

ii. Close the mirror.

E18 dCh

CAUSE

i. There is no connection to the PC. The "Link OK" LED on the PCI is off.

ii. or DfW (not in USA), or the dental imaging software you are using or the User Interface are not on

iii. or the CCD sensor is not attached to the sensor holder

iv. or the CCD sensor is attached to the wrong sensor holder (pan/ceph units only)

v. or the CCD sensor is not fully locked in position

SOLUTION

i. Switch the PC on and start DfW (not in USA), or the dental imaging software you are using and start the User Interface program

ii. Start DfW (and press the Image Capture button) (not in USA) and the User Interface.

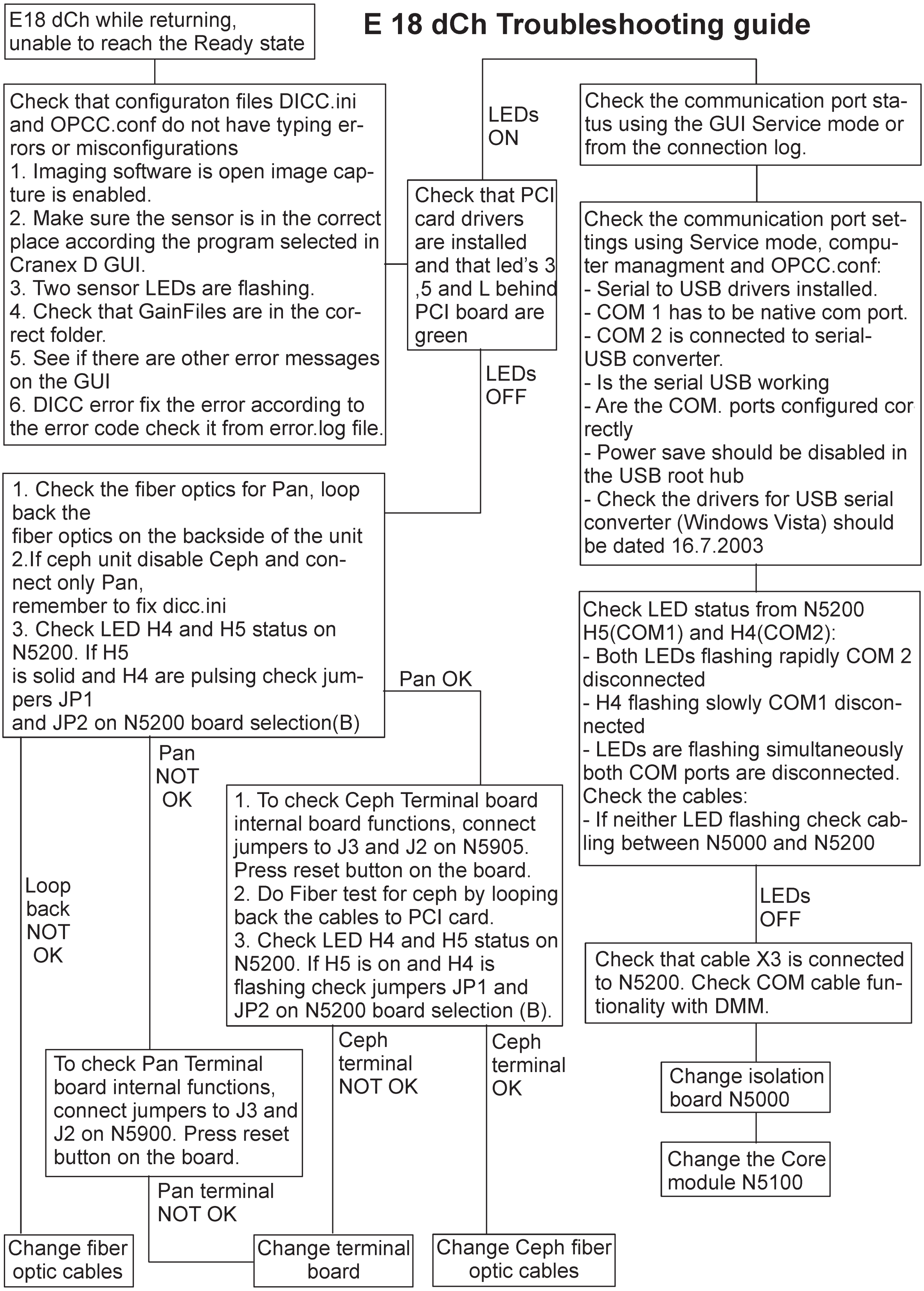
iii. Attach the CCD sensor to the sensor holder.

iv. Attach the CCD sensor to the correct pan or ceph sensor holder.

v. Make sure that the CCD sensor locking lever is pushed fully to the left, the locked position.

vi. If the error message keeps reappearing, make sure that the file "dicc.ini" C:/ Program Files/Soredex/ includes the correct devices.
If the unit is a Pan only it should state "Devices=PP1PAN"
If the unit is a Pan/Ceph it should state "Devices=PP1PAN,PP1CEPH".

E 18 dCh Troubleshooting guide



E19LbL

CAUSE

The PC acknowledges the image identification data, but the data is corrupted.

SOLUTION

Check that the cables between the PC and unit are connected.

C1 HHo

CAUSE

The thermal switch in the tube head has been activated because the unit has over heated because of extended continuous use.

SOLUTION

Wait at least one hour for the tube head to cool down. Note that you will not be able to clear the error message until the tube head has cooled to the correct temperature. If the error message appears even if the unit has not been used a lot, switch the unit off and then on again.

If the error message reappears the thermal switch may be defective. The N5200 board or the tubehead may be faulty and have to be replaced.

C2 (*******) (the mains voltage is displayed)

CAUSE

The mains voltage out of allowed tolerances.

SOLUTION

Check that mains power supply is correct (115/230V, refer type label).
On N4700, N3200 and N3300 check that the +25V LEDS are on.
If not, check the fuses on N4700. Also measure the voltages from N4700.

C3 gEn

CAUSE

Tube fail signal activated. Tube head or generator defected.

SOLUTION

This error code may also appear when the exposure button is released too early. Therefore, press the ***Return*** *key to see if there is another error code, E 7 Rel (exposure button released during exposure).*
If there is nor second error code, the kV or mA were too low or too high. Check that all connections from N3300 to tubehead are correct and then take another exposure.
Possible faults lie in N3300, N3200 or the tubehead.

C4 Inu

CAUSE
N3300 defect. The voltage of the tube does not increase during an exposure.

SOLUTION
Check that the fuse in N3300 is okay and that during an exposure the LED H1 (310V) comes on.
Make sure that all power supply LEDs are on.
Check that all the connectors from N3300 to the tubehead are okay.
Check that the large capacitors are connected and that they look normal.
Possible faults in N3300 or the tubehead.

C5 FIL

CAUSE
Filament defect. mA does not increase during exposure.

SOLUTION
Check that preheat is set correctly (approximately 80 - 120). If it is not set correctly reset it (service program ***Sr 13 Prh****). Make sure that LEDs H8, H9, H10 and H11 on N3200 are on at the start of an exposure. Make sure that all LEDs on N4700 are on. Check the mA reference voltage is correct. See section* ***4. Service Programs - Checking the kV/mA Feedback Reference Voltages****.*
Check from Inverter board that the +25V LED on N3300 comes on at the start of an exposure.

C6 EEP

CAUSE
EEPROM defect.

SOLUTION
The content of the EEPROM is corrupted or the EEPROM is damaged. All the configuration data (Ur and Sr settings) may have been lost. Reset the correct values (tube preheat level, Power Up Settings and tube current) and reboot the unit. Replace N5100 if this does not help.

C7 Por

CAUSE
R movement error. Rotation movement time out. The rotating unit has not reached the position sensors within the required time period.

SOLUTION
Check the unit operation by using the I/0 check program. See section ***4. Service Programs - I/0 check program****.*
Check the wiring of the sensors.

C8 PoC

CAUSE
Ceph receptor movement error. Receptor movement time out. The ceph receptor has not reached the position sensors within the required time period.

SOLUTION
Check the operation and wiring of the sensors.

C9 PoL

CAUSE
Linear (Y) movement error. Linear movement time out. The rotating unit has not reached the linear position sensors within the required time period.

SOLUTION
Check the operation and wiring of the sensors.

C10 PoU

CAUSE
Z movement error. Z movement time out. The vertical carriage has not reached the position sensors within the required time period.

SOLUTION
Check the operation and wiring of the sensors.

C11 Poc

CAUSE
Cephalo movement error. Cephalo movement time out. The cephalo has not reached the position sensors within the required time period.

SOLUTION
Check the operation and wiring of the sensors

C12 SEn

CAUSE
CCD sensor base frequency failing.

SOLUTION
Restart unit. Try with another CCD sensor.

C13 (*******) (the wait time will appear in seconds)

CAUSE

Stepping motors over heated. Stepper motors have overheated because of overuse.

SOLUTION

Allow the wait time to elapse. Then clear the error and continue.

C14 Cba

CAUSE

Cephalo beam misaligned. The sensor on N6100 does not detect x-rays.

SOLUTION

*Check that x-ray beam hits secondary collimator. Check also that the N6100 is correctly adjusted readjust if necessary. Refer to **Circuit Boards** - N6100.*
Other possible causes may be:

- *incorrect beam alignment of the unit (refer installation manual for information on how to align the beam) or*
- *obstacle in the front of the x-ray source or*
- *damaged sensor on N6100 or*
- *fault in N6100 wiring or*
- *unit does not generate x-rays.*

C15nPC

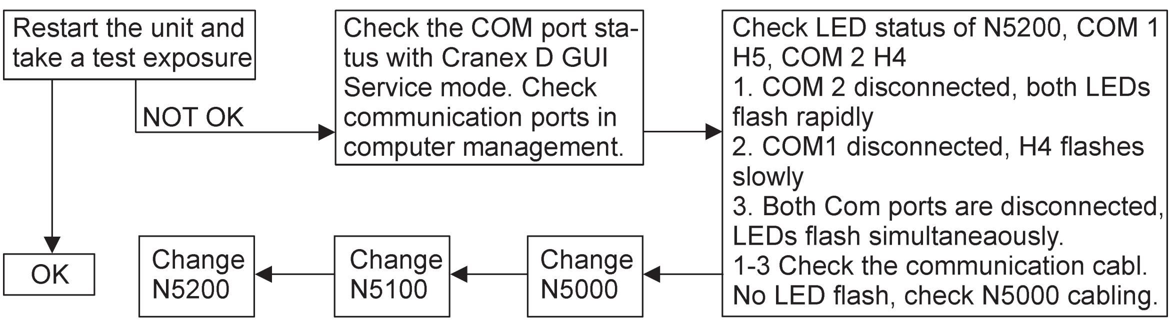
CAUSE

No connection to PC or PC does not acknowledge the image identification data.

SOLUTION

Check that the cables between the PC and unit are connected.

C15nPC



C40 rAM

CAUSE
RAM defect. The RAM memory is damaged.

SOLUTION
Reboot the unit. If error message reappears, replace N5100.

C42 Lin

CAUSE
Mains voltage selector in wrong position.

SOLUTION
Place the voltage selector connector on N4700 in the correct position.

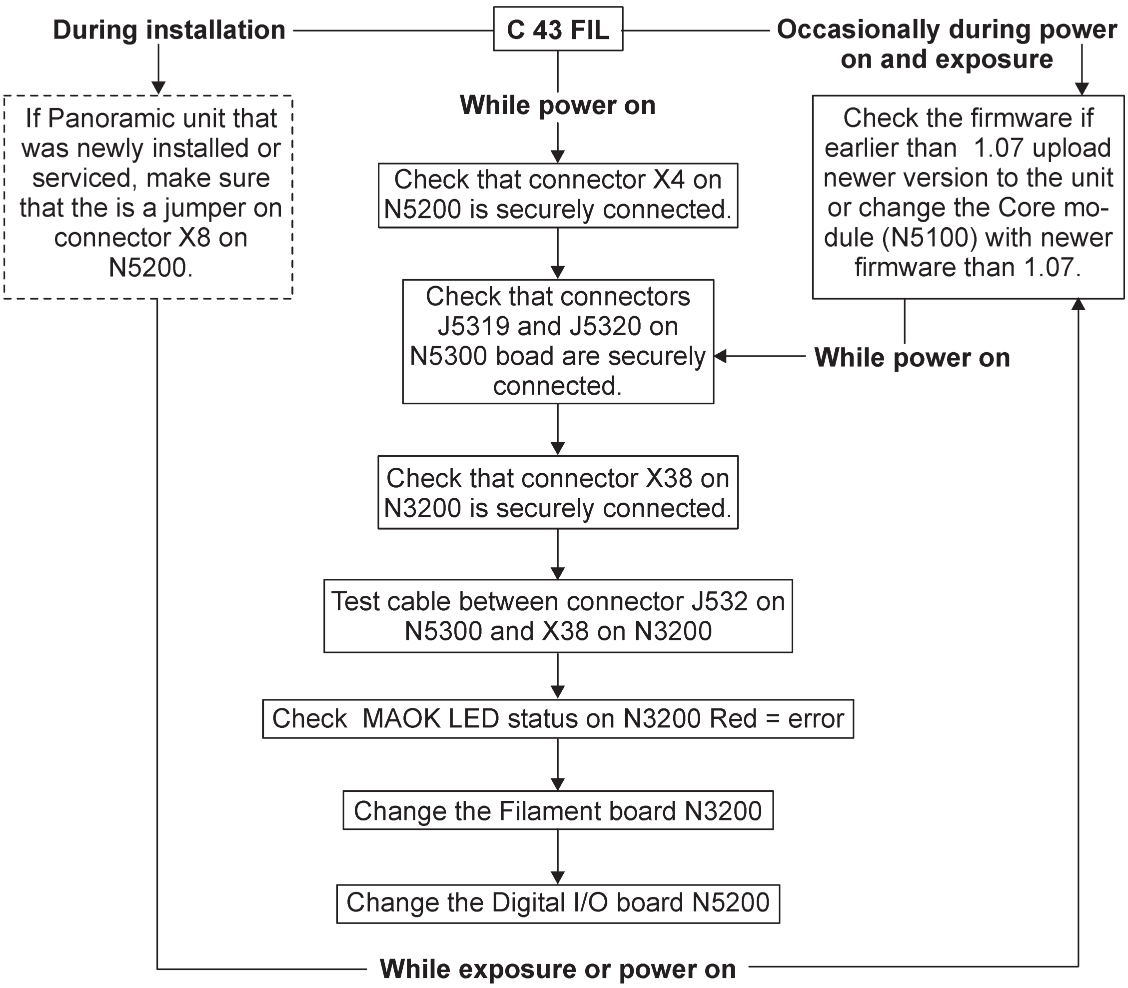
C43 FIL

CAUSE
Preheat circuit not functioning/preheat not calibrated on N3200.
The mAfreq-signal is missing or not within the allowable range due to:

- Preheat circuit not functioning
- Connector X8 not connected to N5200 (supply voltage to optoisolators)

SOLUTION
Recalibrate the unit.
Check that all cables from the rotating unit are connected to N5300.
Check that there is a connector going to X8 and verify that the signal Filt15 exists.
Run preheat program, see section ***4. Service Programs - Sr 13 Prh - Preheat program****. Make sure that the preheat value is somewhere between 70-120.*

C 43 Filament error troubleshooting guide



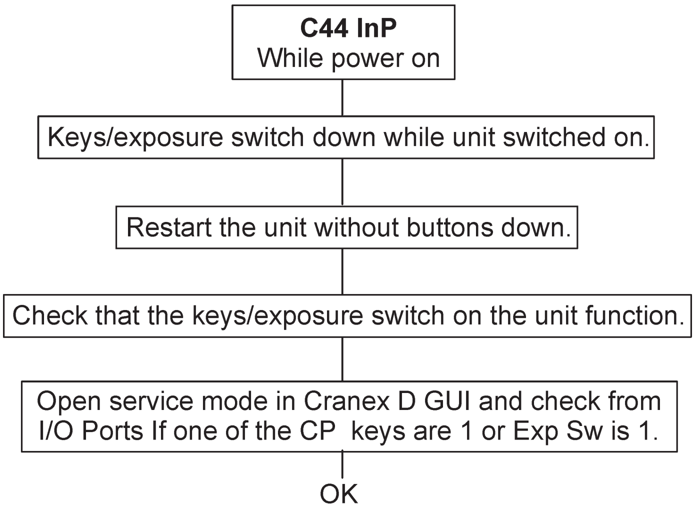
C44 InP

CAUSE

A key is held or stuck down. A control panel key or the exposure switch is held down during start-up.

SOLUTION

Check that no control panel keys or that exposure button are stuck down. Restart the unit.
Replace the control panel board and/or the exposure switch.



C46 cPu

CAUSE

CPU defect.

SOLUTION

N5100 is damaged, replace it.

C51 UIb (Only PC user’s interface)

CAUSE

User Interface busy. The unit is in the “service” mode.

SOLUTION

Reset error codes from control panel.

7.4 Other problems

The soft tissue filter does not work

Check that N4355 receives supply voltages from N4200. If it does not, replace N4355.
Check also that nasio frequency is adjusted correctly. See section **Circuit Board description - N5900/N5905 Terminal board - Nasion Support Frequency Adjustment**.

Patient positioning lights do not come on

If one of the positioning lights does not work, replace the appropriate N4100 board.
If none of the positioning lights come on when you activate them (opening the mirror, adjusting the focal through or driving the unit vertically), Check that N3500 and N5200 are functioning by measuring the "Projlit" signal. Replace any board that is not functioning correctly.

The Vertical-carriage does not move when the up/down keys are pressed.

1. Make sure that the emergency stop button is not pressed down.
2. Check that the unit has not run into the mechanical ends of the z-movement. This is unlikely but if the z-movement end-switches are broken or disconnected it could happen.
   If the unit is at either mechanical end, release the jammed Z-motor see **8.3 Releasing a jammed Z-motor** and repair the end-switches.
3. Check that emergency switch is not pressed or it is disconnected from N3500. The ESTOP LED must be on if this is OK.
4. Check that when the UP/DOWN buttons are pressed LEDs ZENA and ZENA1- come on.
5. If the unit is a Pan make sure that jumper J1 is connected to N3500. If the unit is a Pan/Ceph make sure that there is NO jumper.

6. If all the signals are correct, disconnect the unit from the mains and check the motor fuse on N3500. If the fuse is blown replace with same the same type and rating.

7. Connect the unit to the mains. Use a DVM to measure the AC voltage fed to the AC-motor. Press the UP/DOWN key and check that there is an AC-voltage. Note that you need to connect the DVM differently when running the unit in the Up direction and in the Down direction.

8. Disconnect the unit from mains. Remove the column front cover and check that the cable from N3500 to the motor is in good condition.

Sensor, detector or microswitch problems

If you suspect that a sensor, detector or microswitch is faulty, you can check the state of it using the Service mode. See section **4. Service Programs - I/O check program**.
If possible, activate the sensor, detector or microswitch you think is faulty (by manually moving the appropriate part of unit), and check that the I/O-signal state changes accordingly.

Nothing happens when the unit is switched on

If the control panel does not light up when the unit is switched on check the following:

- mains power cable is connected to main power supply.

- the main power supply is on.

- disconnect the unit from mains and check the condition of the mains fuses, see section **6. Circuit board description - N3500 Motor Controller board**.

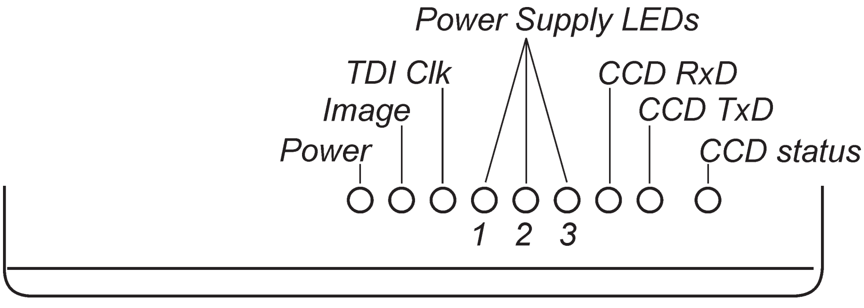
- reconnect the unit to the main power supply. Remove the upper shelf covers. Check that the LEDs on N4700 that indicate supply voltages are on.

- verify that all connectors are properly connected.

7.5 OCD problems

CCD sensor LEDs

On the rear of the CCD sensor there are a number LEDs the indicate the status of the CCD sensor.



- **CCD status LED** (three colour)
  It indicates that the CCD is connected, all the software has been downloaded and it is ready to take and.
  Green, in stand-by mode (power signal not active).
  Green flashing, mode conflict, e.g. a pan exposure has been selected but the CCD sensor is attached to the ceph head.
  Yellow, image capture mode (power on).
  Red, in position but not yet ready, SW is being loaded.
  Red flashing, fatal SW error / communication routine failure after an image has been taken.
  NOTE! The LED will flash red when using service program *Sr 11 EPS*.

- **CCD TxD** and **CCD RxD LEDs** (yellow) serial communication. In normal operation they flash intermittently.
  They indicate communication activity. If CCD RxD is off (passive CCD sensor), CCD TxD will also be off. If CCD TxD is off, CCD RxD is on and the CCD status LED flashes during and after image capture it indicates that the CCD sensor tried to receive the image, but the transmit communication routine failed.

- **Power Supply LEDs** (yellow) indicate the different voltages required by the CCD sensor. The IC in the CCD sensor monitors the voltages and activates the LEDs accordingly. The software set limits for the various supply voltages. The LEDs come on during image capture.

LED 1. +3.3V and +1.8V LEDs
Supply voltages for the CCD clock controlling FPGA.
The +3.3V is generated in DIB from VCC_+5V.
The +1.8V step down is generated in camera board from +3.3V (from DIB).
LIMITS:
+3.3V between +3.0 and +3.6V
+1.8V between +1.71V and +1.89V.

LED 2. Analog +5V LED
DIB generates this voltage from VSP_+5V
Supply voltage for AD-converters
LIMITS
between +4.5V and +5.5V

LED 3. +15V, +3V and –9V LED
DIB generates these voltages from VAP_+18V
CCD gate voltages
LIMITS:
+15V between +13.5V to +16.5V
+3V between +2.4V and +3.6V
-9V between -9.92V and -9.17V

Another required voltage is cam_permanent_+5V (signal name on the DIB board). It is used to power the IC. If this voltage is missing all the LEDs will be off.

- **TDI clk LED** (yellow). Indicates that the clocking frequency of CCD is available.
  LED Off - TDI frequency is between 0...50Hz
  LED On - TDI frequency is between 100 Hz...1kHz
  LED Flashing - TDI frequency is between 50...100Hz or above 1kHz.

- **Image LED** (yellow). Indicates pimage/cimage signal activity. It tells camera A/D-converter to sample image data according to the TDI frequency.

- **Power LED** (yellow) Indicates that ppower/cpower signal is active. Switching regulators of DIB board are enabled after ppower/cpower signal becoming active.

Debugging software

The Debug View software (on the Service CD) allows the serial communication between the CPU, CCD-sensor and PC (DICC driver) to be debugged.
When the unit is ready to take an exposure, press the exposure button and the imaging program ID, the selected parameters (kV/mA/s) will appear in the debug view window.

8. Replacing Parts

8.1 Replacing the tube head

IMPORTANT NOTE:
Tubeheads with s/n 9102000 use N3301
Tubeheads with s/n 9000000 to 9001999 use N3300

Removing the tube head

1. Remove the tube head cover. See **3. Covers and cover removal**. Remove also the small, metal cover beneath the tubehead.

2. Remove the pan head support and rotating part inner upper cover. See section **3. Covers and cover removal**.

3. Disconnect the tube head ground lead. It is screwed to the rotating unit frame. Disconnect the tubehead cables from N3300 / N3301 board.

4. The tubehead is fixed to the rotating unit with two screws in the top of the tubehead front, two nuts in the middle of the tubehead front and two pins in the top of tubehead front. Remove the screws and loosen the nuts. Tubehead will stay in place with the pins.

5. Remove the tubehead by first pulling it outwards in order to depart it from the pins and then slowly letting it to slide down from its place.

   WARNING:
   Tubehead weights 4 kg. Be careful NOT to let it drop on floor or on your feet.

   NOTE:
   When sliding the tubehead downwards from its position be careful not to damage any tubehead or collimator assembly parts

Installing a new tube head

1. Lift the tubehead upwards into its correct position behind the collimator assembly and slide it into the pins, attach it in place with screws (two on the upper part of tubehead front) and two nuts (in the middle of tubehead front).
2. If necessary replace N3300 with N3301.
3. Insert the tubehead connectors into the connectors of Inverter (N3300 / N3301) board. Connect the ground wire of tubehead into the rotating part.
4. Run the tube warming up procedure before using the tubehead for panoramic exposures. To warm up the tubehead

   - switch on the unit
   - activate service program **Sr 12 PUP**, see **4. Service programs**. (use service connector in X90 of IO-board).
   - protect yourself from radiation and press exposure button and let the unit warm up the tubehead automatically.
5. Adjust the tube preheat level in the following way.

   - switch on the unit
   - select sevice program **Sr 13 Prh**, see **4. Service programs**.
   - protect yourself from radiation and press exposure button and let the unit calibrate the preheat level automatically
   - preheat level is now adjusted
6. When tubehead is changed the position of focal spot is changed slightly and therefore the alignment of x-ray beam may not be correct. Adjust the alignment of the unit, see installation manual how to do this

8.2 Adjusting the panoramic slit collimator

Note! Normally it should not be necessary to touch the moving slit width at all. Do not adjust unless the slit width is incorrect. The slit width is adjusted when the rotating part is in PIO position (=perpendicular to the upper shelf)

1. Loosen the 2mm set (allen) screw in the slit shaft (just above the slit). Leave the allen key in place to prevent the shaft from turning during adjustment.
2. Adjust the slit width by turning the adjustment cone from below. A flat screwdriver slot is found in the adjustment cone. Use a thin and long screwdriver. When you turn CW the slit width decreases and vice versa.
3. Correct adjustment is achieved when the slit is 0.9mm. Use a feeler gauge to define the slit width. The feeler gauge should be placed between the whole length of the slit. Note that slit is made of lead which is a soft material. Do not scratch or damage the inner slit surface. Damage may be seen on images.
4. Tighten the set screw.

8.3 Releasing a jammed Z-motor

Z-motor (up/down) may get jammed if z-micro switches are out of order.

1. If z-carriage is jammed in the topmost position remove the column front cover (see cover removal).

   Use a wrench to turn the z-motor shaft (as close as the motor as possible) CCW unitl the motor releases. Replace covers.

2. If z-carriage is jammed in the lowermost position loosen the nuts holding the column front cover in place and pull the cover down. Note the cover will not come off, it will only move downwards to the floor.

   Locate the z-motor shaft. From above use a extra long 8mm allen key and turn the motor CW until motor releases. Replace covers.

9. Annual Service

The following tests and inspections must be carried out annually by an authorized service person to verify that the Cranex D X-ray unit meets the specifications and performance criteria essential for correct operation.
When taking measurements that require a multimeter, always use a calibrated digital multimeter (DMM).

9.1 mA test

WARNING: X-rays are generated when this test is carried out.

1. Connect the +probe of a DMM to test pin TP2 and the -probe to TP 1 on the Filament board (N3200).

2. Select service program ***Sr11 EPS***, 85kV, 1.6s.

3. Protect yourself from radiation and take exposures using first 8mA and then 10mA. Check the feedback values from the DMM.
   The feedback values must be within the tolerances shown.

Selected mA	mAfb1 (V)	Tolerance (V)
8	1.94	±0.16 (1.78 - 2.1)
10	2.43	±0.2 (2.23 - 2.63)

   If the either of the values are not with the recommended tolerances, there may be a problem with the Filament board (N3200) and/or the tubehead.

9.2 kV test

WARNING: X-rays are generated when this test is carried out.

1. Connect the +probe of a DMM to test pin TP18 and the -probe to TP16 on the Inverter board (N3300).

2. Select service program ***Sr11 EPS***, 85kV, 10 or 8 mA, depending on the setting of the unit, and an exposure time of 1.6s.

3. Protect yourself from radiation and take exposures using the kV values listed in the table below. Check the feedback values from the DMM. The feedback values must be within the tolerances shown.

Selected kV	**kVfb1 (V)**	**Tolerance (V)**
57	2.85	±0.18 (2.67 - 3.13)
70	3.50	±0.18 (3.32 - 3.68)
85	4.25	±0.18 (4.07 - 4.43)

   If the values are not within the recommended tolerances, there may be a problem with the N3300 board, the N3200 board or the tubehead.

9.3 Exposure time test (pan/ceph units only)

WARNING: X-rays are generated when this test is carried out.

1. Select any cephalometric program.

2. Connect the +probe of a storage oscilloscope to test pin TP24 and the -probe to TP29 on the Filament board (N3200).

3. Protect yourself from radiation and take exposures using the exposure times listed in the table below. Check the times from the oscilloscope. The times must be within the tolerances shown.

Time selected	Tolerance
8 sec	±0.6 sec (7.4 - 8.6)
20 sec	±1.6 sec (18.4 - 21.6)

9.4 Motor Movements

Switch the unit off and then manually check that all the stepper motors move freely and without any looseness:

– rotate the C-arm to check the R-motor

– push the rotating unit in and out to check the Y-motor

Also turn the x-rays off and take various exposures to check that the motors operate smoothly and without any noise.

Press the up/down keys to check the Z-motor (vertical carriage movement). The motor must operate smoothly and without any noise.

9.5 Position Detectors

Z-Movement Sensors

Press the up key and drive the unit up. Make sure that the unit stops moving at its uppermost position.
Press the down key and drive the unit down. Make sure that the unit stops moving at its lowermost position.

9.6 Image receptor detection

Panoramic

Remove the CCD sensor. Switch the unit on and check that an error message appears. This indicates that the unit cannot take a panoramic exposure because the CCD sensor is not in position.
Now replace the CCD sensor, clear the error message and check that the unit is now ready to take a panoramic exposure.

Cephalometric

Repeat the above procedure but this time with the ceph head and any cephalometric program.

9.7 Panoramic Alignment

WARNING: X-rays are generated when this test is carried out.

1. Set the unit and dental imging software you are using to take a normal panoramic exposure.
   Set the layer position to 0 (press the arrow keys) and select the lowest kV value 63 (refer to the installation manual).

2. Place the ball phantom into the chin support.

3. Protect yourself from radiation and take a panoramic exposure of the ball phantom.

   The exposed area on the screen must not extend beyond any of the edges of the active area of the CCD sensor. The balls must also be round.

   If exposed area extends beyond the edges of the active area of the CCD sensor, the height of the x-ray field must be adjusted.
   If the balls are not round (the difference between the height and the width is more than 20%), the rotation axis must be readjusted.
   Refer to the installation manual for information on how to carry out these adjustments.

9.8 Cephalometric Alignment

1. Set the unit and dental imaging software you are using to take a normal cephalometric exposure.
   Pull the nasion support out as far as it will go so that there is NO soft tissue filtering. Select the lowest kV value, 63, and the shortest exposure time.

2. Protect yourself from radiation and take a cephalometric exposure.

   The exposed area on the screen must not extend beyond any of the edges of the active area of the CCD sensor.

   If exposed area extends beyond the edges of the active area of the CCD sensor, the ceph head will have to be realigned.
   Refer to the installation manual for information on how to do this.

9.10 Soft Filter Alignment

1. Set the unit and dental imaging software you are using to take a normal cephalometric exposure. Position the nasion support in the middle of its adjustable range.

2. Protect yourself from radiation and take a cephalometric exposure.

   Check that the edge of the filter (where the exposed field gets darker) coincides with the image of the nasion support. The accuracy is ±10mm.

   Soft tissue filtering is carried out by software which increases kV/mA so that the soft tissue to be seen on the image. The point at which the kV/mA are increased is based the position **(frequency)** of the nasion support.

   If the nasion support **frequency** is not correctly positioned, it must be adjusted. **See section 4 (N5900) for information on how to do this.**

9.11 Patient Positioning Lights

Use the ball phantom to check the operation and alignment of the patient positioning lights. Refer to installation manual for information on how to do this.

9.12 Covers and Labels

Check that all covers are correctly installed and in good condition. Also check that all the labels are attached to the unit and that they are all legible.

9.13 Other checks

- **WARNING:** Disconnect the unit from the mains before carring out the next test.
  Check the safety ground continuity by measuring the grounding resistance between the PE connector of the mains cord and any touchable metallic part of the unit chassis. It MUST be <0.2 ohm.

- Check that oil is not leaking from the tubehead.

- **WARNING:** Disconnect the unit from the mains before carring out the next test.
  Vacuum clean all visible dust from inside the unit.

- Check the condition of mains cord and replace if not in perfect condition.

10. Image Appearance - s/n B81642 and earlier only

The images are stored into the DfW database using 16 bits.
The filtering parameters which are used when opening the image can be changed to improve image quality.

10.1 Using the 16-bit format

This method is based on the system register settings of Digora for Windows.

All 16-bit images are stored in a database as <u>technical images</u> (i.e. a raw image only processed with gain correction, dark current removal and removal of 2-pixel-wide gaps between sensor chips). The image does not look optimal at this phase.

When an image is opened, the image is automatically filtered to get the optimum gray scale distribution. This filtering operation is performed on all image types (pan, child, TMJ, Ceph Lateral, Ceph PA/AP and partial panoramic) when the image is opened.

10.2 Setting 16-bit filtering and changing filter parameters

NOTE! 16-bit storage and filtering in ON by default. If image quality needs to be modified, that can be done by changing the filter parameters.

Run the program Regedit from Microsoft® Windows® Operating System and open the registry of:

\HKEY_LOCAL_MACHINE\Software\Soredex\Digora\Dicc\

Ther are configurable register keys on the main level (decimal values for register keys in all cases):

- ***<u>UseIIFilter3</u>***

When the value is 1 (default), filtering is used when opening the images from the database (the raw images that were stored in 16-bit format)
When the value is 0, the images are not filtered when they are opened. DO NOT USE the 0 value.

- ***Gamma***

No functionality, reserved for future use.

- ***Start***

Value should be set to 1.

Sub-folders of
\HKEY_LOCAL_MACHINE\Software\Soredex\Digora\Dicc\
includes:
- P1sdxPan
- P2sdxChild
- P3sdxTMJ
- P4sdxCephLAT
- P5sdxCephPA

These sub-folders include the program specific filter parameters.

GammaFactor, (default depends on program)
the higher the value the lighter the images will appear.
Range 0…100.

OffsetParam**=0** (default depends on program)
This can be used to increase the image contrast by ignoring the areas that have received direct radiation .
Range 0....100. Increasing the value will "over-exposed" the image at certain points.

BottomMargin
LeftMargin
TopMargin
RightMargin

These register keys define how great an area of the edge(s) (percentage) will be ignored before the image histogram is calculated (gray scale distribution). Value between 0…100.

Appendix A1 - Technical Information

A1.1 Technical specifications

Model

PP1

Classification

IEC class I, type B, IP20.
Conforms with the standards EN 60601-1, EN60601-1-3, EN 60601-2-7 and EN 60601-1-2 (Group 1, class B).

Conforms with the regulations of DHHS Radiation Performance Standard, 21CFR Subchapter J.

The unit must be installed within a protected clinical area.

Protection against electric shock - Class 1.
Degree of protection - Type B applied parts with no conductive connection to patient.
Protection against ingress of liquids - IPX 0
Disinfection methods:

- mild soapy water
- non-alcholic based disinfectant for the chin rest
- disposable plastic covers for bite piece/chin support

For use in environments where no flammable anaesthics and/or flammable cleaning agents are present.
Mode of operation - continuous operation/intermittent loading

Unit description

Dental panoramic and panoramic/cephalometric x-ray units with a high frequency switching mode x-ray generator. The panoramic version takes panoramic exposures. The panoramic/cephalometric version takes panoramic and cephalometric exposures. The unit uses a CCD sensor as image receptor.

X-ray generator

TUBE
- OPX/105, or equivalent

FOCAL SPOT
- 0.5 mm IEC 336

TARGET ANGLE
- 5º

TARGET MATERIAL
- Tungsten

OPERATING TUBE POTENTIAL
- Panoramic imaging 57 - 85 kV (±4 kV)
- Cephalometric imaging 60-85 kV (±4 kV)

OPERATING TUBE CURRENT
- 10 mA (±1 mA) at 0.5 FS

MAXIMUM TUBE CURRENT
- 11 mA

MAXIMUM OUTPUT POWER
- 945 W nominal

FILTRATION
- minimum filtration 2.7 mm Al

BEAM QUALITY
- HVL over 3.05 mm Al @ 85 kV

OUTER SHELL TEMPERATURE
- +50ºC (122ºF) maximum

DUTY CYCLE
- controlled by the software of the unit

Power requirements

INPUT VOLTAGE
- 230 or 115 VAC (±10%), 50/60 Hz, single phase, grounded socket

MAXIMUM LINE CURRENT
- 7 A (@85 kV/10mA, 230 VAC mains)

MAXIMUM LINE RESISTANCE
- 1 ohm

MAXIMUM LINE FUSING
- 10 A /20A slow @ 230/115 VAC (main fuse 8A/16A slow in the device)

LINE SAFETY SWITCH (when required)
- Approved type, min. 10 A 250 VAC

EARTH LEAKAGE CIRCUIT BREAKER (when required)
- Approved type, min. 16 A 250 VAC, breaker activation leakage current in accordance with local regulations.

Mechanical parameters

PANORAMIC
- Source to Image layer Distance (SID) 520 mm (±10 mm)
- Magnification factor 1.34

CEPHALOMETRIC
- Source to Image layer Distance (SID) 1721 mm ±20 mm
- Source to Object Distance (SOD) 1500mm
- Magnification factor 1.15

WEIGHT
- Panoramic unit 120 kg
- Panoramic/cepahlometric unit 165 kg

DIMENSIONS
- Panoramic unit (H x W x D) 2320 x 1200 x 1000 mm
- Panoramic/cephalometric unit (H x W x D) 2320 x 1200 x 1900 mm

VERTICAL HEIGHT OF CHIN REST
- 950 - 1750 mm (+- 10 mm)

Digital image receptor

Only the CCD sensors specifically designed for Cranex D unit can be used.

PIXEL SIZE
- 96 micrometres

Timer

PANORAMIC EXPOSURE TIMES

- Normal	17.6 s (±15%)
- Child	16 s (±15%)
- Partial	1.9 s - 3 s - 9.2 s - 3 s - 1.9 s Can be freely selected and combined, overlapping approx. 0.3 s.
- TMJ	3.3 + 3.3 s (±15%) Max 240 mAs

CEPHALOMETRIC EXPOSURE TIMES
- 8 - 20 s scanning times, 5 steps according to R’10 series (ISO)

BACK-UP TIMER
- 23.5 s (±1.5s)

Leakage technique factors

PANORAMIC
- 85 kV, 2400 mAs/h (85 kV, 10 mA, duty cycle 1:15)

CEPHALOMETRIC
- 85 kV, 1800 mAs/h (85 kV, 10 mA, duty cycle 1:20)

Measurement bases

kV and mA values can be verified with a specified digital multimeter according to separate measurement instructions. The exposure times can be measured as the duration of radiation in the primary radiation beam.

Exposed field size in cephalometry

- 22 x 26 cm for lateral projections
- 22 x 22 cm for PA and AP projections
- Automatic filtration of soft tissues for lateral projections controlled by software.

Operating ambient conditions

- Operating temperature 10 - 40ºC
- Relative humidity 0 - 85 RH%

Storage ambient conditions

- Storage temperature 0 - 40ºC
- Relative humidity 0 - 85 RH%

Minimum computer requirements

The values in (brackets) are recommended values.

OPERATING SYSTEM
- Windows XP Professional / Home / SP1 or SP2
- Windows 2000 Professional / SP4

CPU
- Pentium 4 or Athlon XP or equivalent (1.5 GHz or better recommended)

RAM
- 256 MB (512 MB recommended)

HDD
- 20 GB (single user)

VIDEO RAM
- 16 MB (or more)

NETWORK CONNECTION
- 10/100 Mbit/s Ethernet NIC

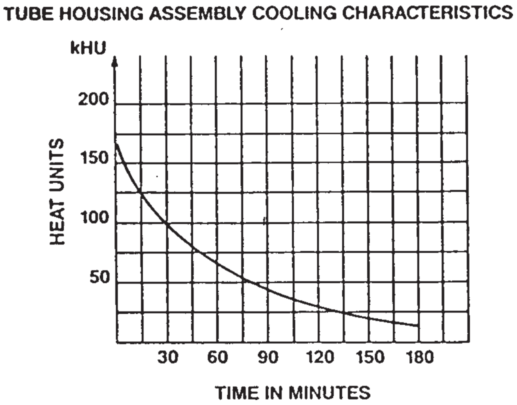
DISPLAY
- 1280 x 1024 x 24-bit Tru Color, 85Hz display
  (19" CRT or 17" TFT LCD recommended)

PCI slot
- one free for N3000

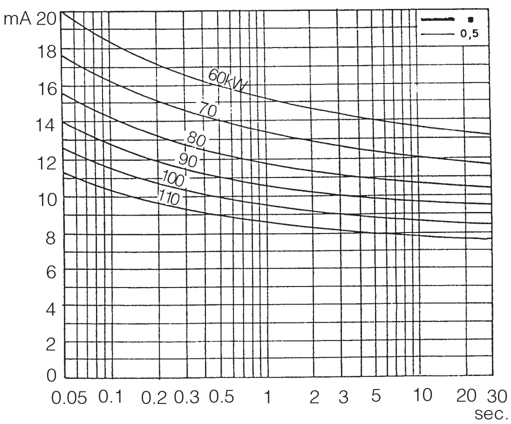
COM 1 and COM 2
- free s/n **B81642 and earlier**

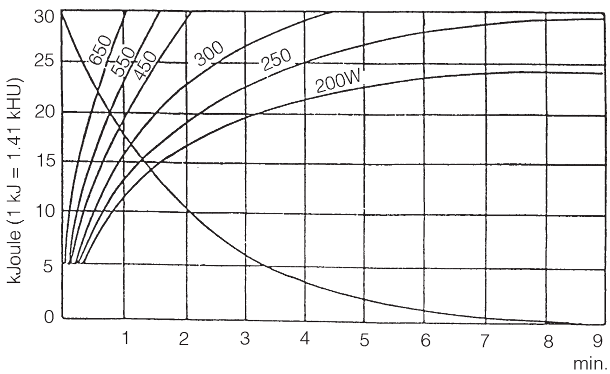
Connection to the PC must meet EN60601-1 requirements.
The use of ACCESSORY equipment not complying with the equivalent safety requirements of this equipment may lead to a reduced level of safety of the resulting system.
Consideration relating to the choice shall include:
- use of the accessory in the PATIENT VICINITY
- evidence that the safety certification of the ACCESSORY has been performed in accordance to the appropriate IEC 601-1 and/or IEC 601-1-1 harmonized national standard
- the fibre optic cable, provided by the manufacturer, shall be used, s/n **B91643 and later**.
- only RS 232C interface cable and fibre cable, provided by the manufacturer, shall be used, s/n **B81642 and earlier**.

Tube housing assembly cooling characteristics

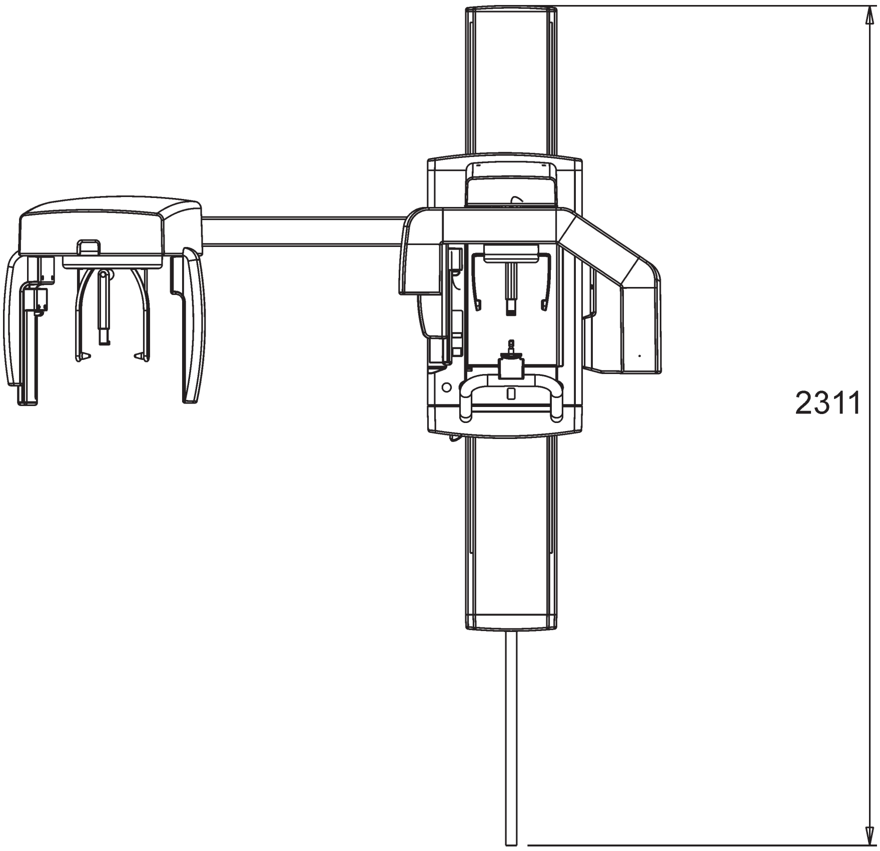


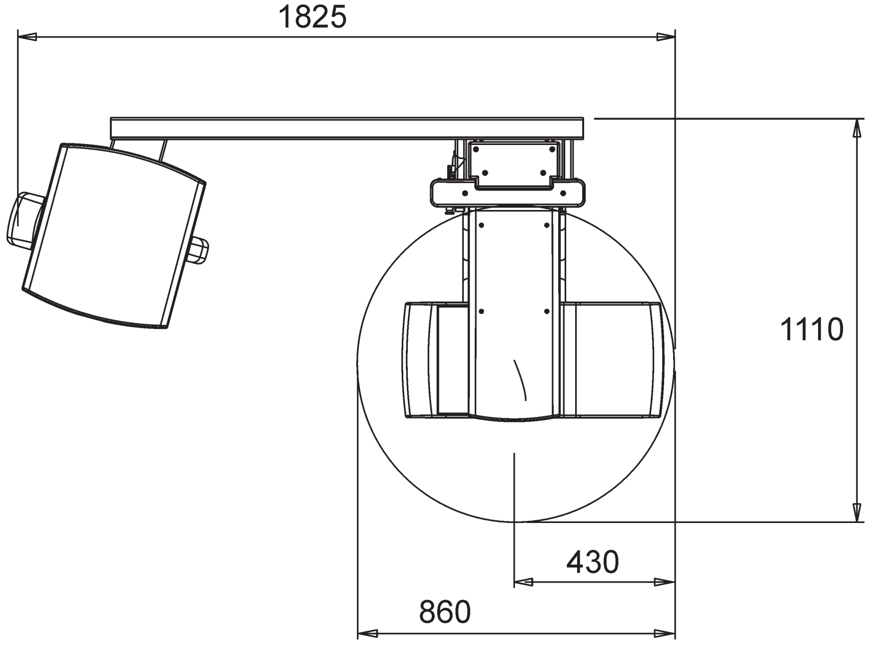
OPX/105 and KL5





A1.2 Unit dimensions





A1.3 Symbols that appear on the unit

Exposure switch locked

Exposure switch unlocked

On or enabled

Off or disabled

Exposure switch

Ready

Radiation warning

Attention, consult accompanying documents

X-ray source assembly: emitting

Dangerous voltage

Protective earth (ground)

Ground (Functional)

CE (0537) symbol
MDD 93/42/EEC

UL Classification and CSA classification

Type B equipment

This symbol indicates that the waste of electrical and electronic equipment must not be disposed as unsorted municipal waste and must be collected separately. Please contact an authorized representative of the manufacturer for information concerning the decommissioning of your equipment.

<table>
<tr><th colspan="3">Guidance and manufacturer’s declaration – electromagnetic emissions</th></tr>
<tr><td colspan="3">The PP1 is intended for use in the electromagnetic environment specified below. The customer or the user of the PP1 should assure that it is used in such an environment.</td></tr>
<tr><th>Emissions test</th><th>Compliance</th><th>Electromagnetic environment - guidance</th></tr>
<tr><td>RF emissions
CISPR 11</td><td>Group 1</td><td>The PP1 uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment.</td></tr>
<tr><td>RF emissions
CISPR 11</td><td>Class B</td><td rowspan="3">The PP1 is suitable for use in all establishments, including domestic establishments and those directly connected to the public low-voltage power supply network that supplies buildings used for domestic purposes.</td></tr>
<tr><td>Harmonic emissions
IEC 61000-3-2</td><td>Class A</td></tr>
<tr><td>Voltage fluctuations/ flicker emissions
IEC 61000-3-3</td><td>Complies</td></tr>
</table>

Guidance and manufacturer's declaration – electromagnetic immunity			
The PP1 is intended for use in the electromagnetic environment specified below. The customer or the user of the PP1 should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) IEC 61000-4-2	±6 kV contact ±8 kV air	±6 kV contact ±8 kV air	Floors should be wood, concrete or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30 %.
Electrical fast transients/bursts IEC 61000-4-4	±2 kV for power supply lines ±1 kV for input/output lines	±2 kV for power supply lines ±1 kV for input/output lines	Mains power quality should be that of a typical commercial or hospital environment.
Surge IEC 61000-4-5	±1 kV differential mode ±2 kV common mode	±1 kV differential mode ±2 kV common mode	Mains power quality should be that of a typical commercial or hospital environment.
Voltage dips, short interruptions and voltage variations on power supply lines IEC 61000-4-11	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	<5 % U_T (>95 % dip in U_T) for 0.5 cycle 40 % U_T (60 % dip in U_T) for 5 cycles 70 % U_T (30 % dip in U_T) for 25 cycles <5 % U_T (>95 % dip in U_T) for 5 sec	Mains power quality should be that of a typical commercial or hospital environment. If user of the PP1 requires continued operation during power mains interruptions, it is recommended that the PP1 be powered from an uninterruptible power supply or a battery.
Power frequency (50/60 Hz) magnetic field IEC 61000-4-8	3 A/m	3 A/m	Power frequency magnetic field should be at levels characteristic of a typical location in a typical commercial or hospital environment.
NOTE U_T is the a.c. mains voltage prior to application of the test level.			

Guidance and manufacturer's declaration – electromagnetic immunity			
The PP1 is intended for use in the electromagnetic environment specified below. The customer or the user of the PP1 should assure that it is used in such an environment.			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
			Portable and mobile RF communications equipment should be used no closer to any part of the PP1, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance
Conducted RF IEC 61000-4-6	3 Vrms 150 kHz to 80 MHz	3 V	$d = 1.2\sqrt{P}$ $d = 1.2\sqrt{P}$ 80 MHz to 800 MHz $d = 2.3\sqrt{P}$ 800 MHz to 2.5 GHz
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	where *P* is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and *d* is the recommended separation distance in metres (m). Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, [a] should be less than the compliance level in each frequency range. [b] Interference may occur in the vicinity of equipment marked with the following symbol: 
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies. NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
[a] Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicated theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the PP1 is used exceeds the applicable RF compliance level above, the PP1 should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as reorienting of relocating the PP1. [b] Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m.			

Recommended separation distances between portable and mobile RF communications equipment and the PP1.			
The PP1 is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the PP1 can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the PP1 as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter W	Separation distance according to frequency of transmitter m		
	150 kHz to 80 MHz $d = 1.2\sqrt{P}$	80 MHz to 800 MHz $d = 1.2\sqrt{P}$	800 MHz to 2.5 GHz $d = 2.3\sqrt{P}$
0.01	0.12	0.12	0.23
0.1	0.38	0.38	0.73
1	1.2	1.2	2.3
10	3.8	3.8	7.3
100	12	12	23
For transmitters rated at a maximum output power not listed above, the recommended separation distance *d* in meters (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer. NOTE 1. At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies. NOTE 2. These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

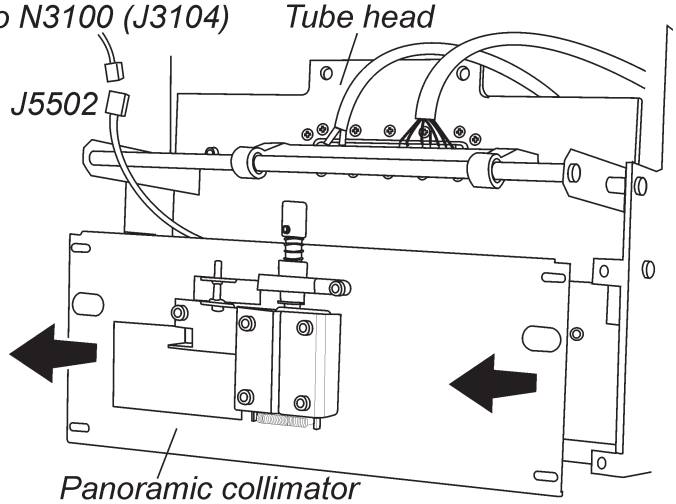
Appendix A2 - Upgrading a Pan unit to Pan/Ceph

A2.1 Replacing the collimator

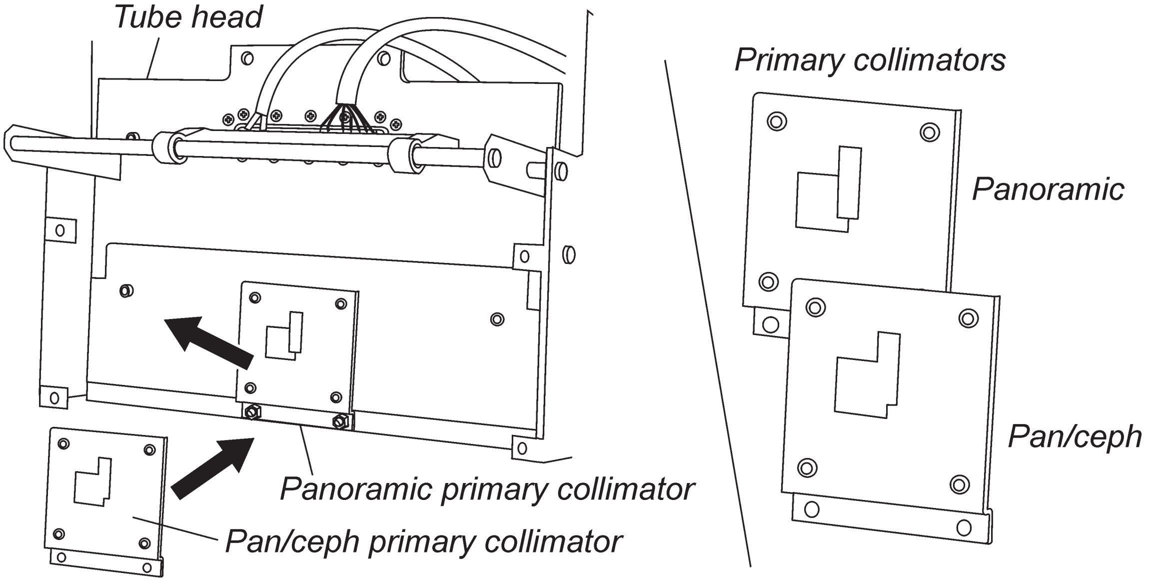
1. Switch the unit off and disconnect it from the power supply.

2. Remove all the covers from the unit. (Refer to the Cranex D Service Manual, section **3. Covers and cover removal** for information on how to do this).

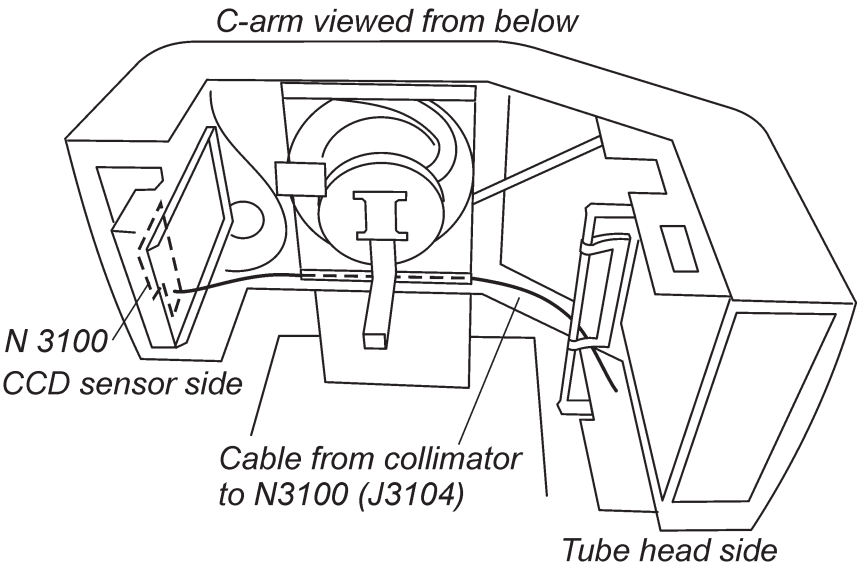
3. Disconnect the short cable (J5502) that connects the panoramic collimator to the cable that goes to N3100 (on the CCD sensor side of the Rotating unit), and then remove the panoramic collimator (4 screws). Keep the screws as they will be need ed to attach the new collimator.



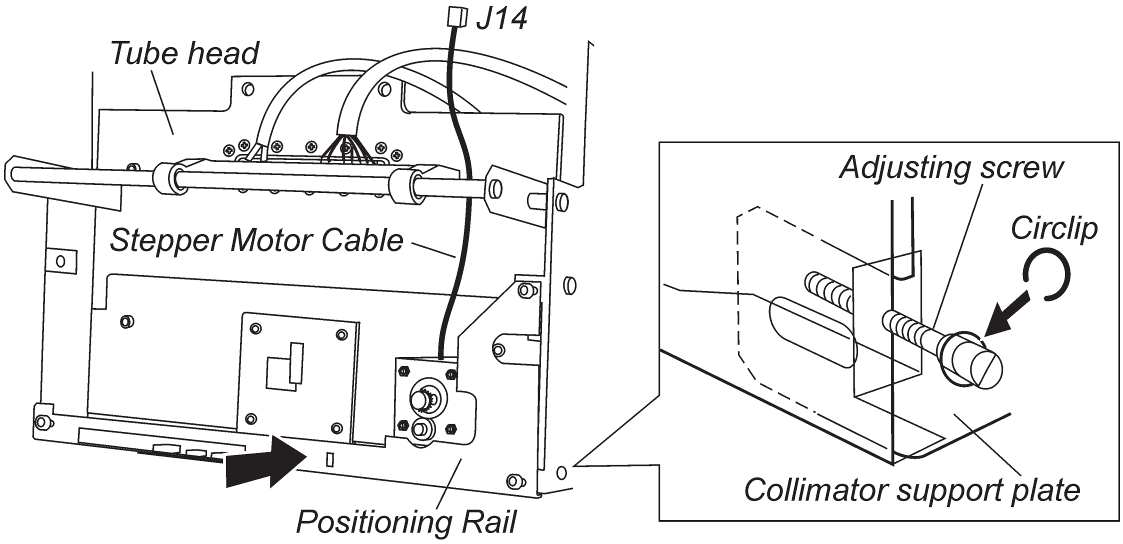
4. Remove the Panoramic primary collimator and replace it with the Pan/ceph primary collimator.



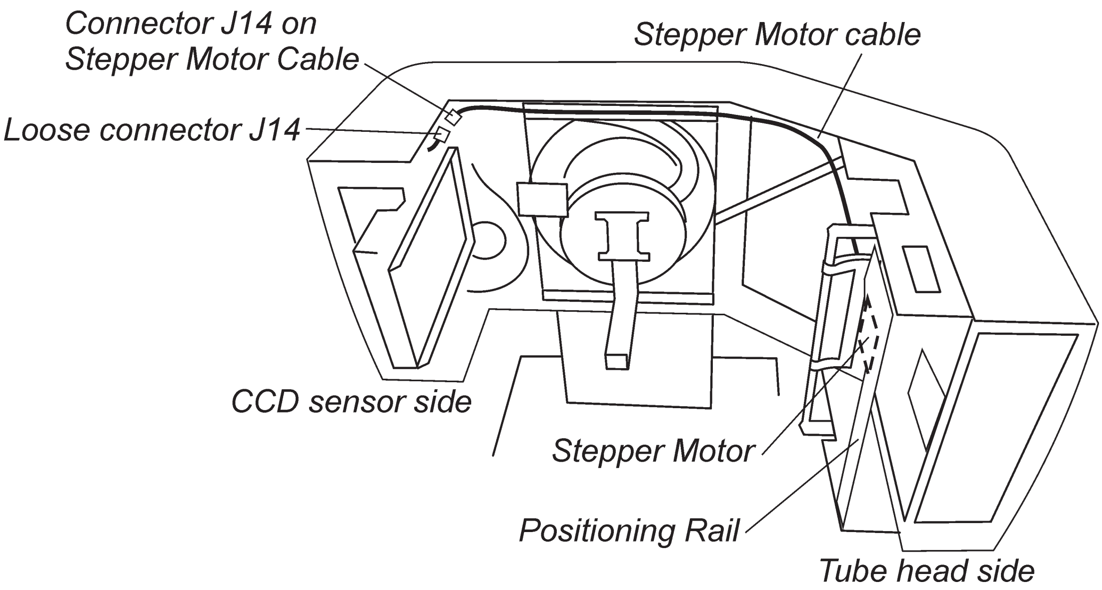
5. Replace the cable that connects the panoramic collimator to N3100 with the new cable supplied. To make cable routing easier tie a piece of string to one end of the cable to be replaced and the other end to the replacement cable. When you pull out the old cable out the new one will be pulled into the correct position.



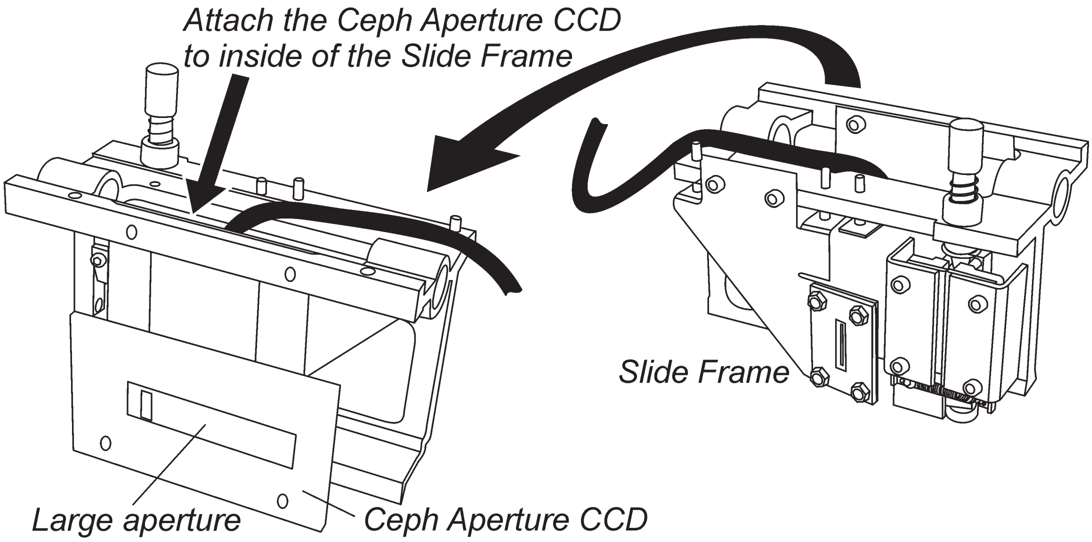
6. Attach the Positioning Rail to the same holes that the Panoranic Collimator was attached (3 screws). Make sure that the Adjusting screw in the side of the Positioning Rail goes through the hole in the side of the Colimator support plate. Attach the circlip to the adjusting screw.



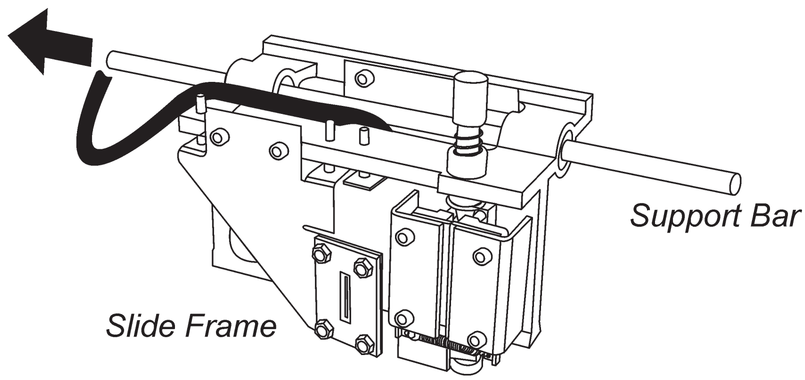
7. There is a Stepper Motor attached to the Positioning Rail. Route the cable that comes from the Stepper Motor across the inside of the C-arm to loose connector J14 on the CCD Sensor side. Secure the Stepper Motor cable to the other cables with cable ties.



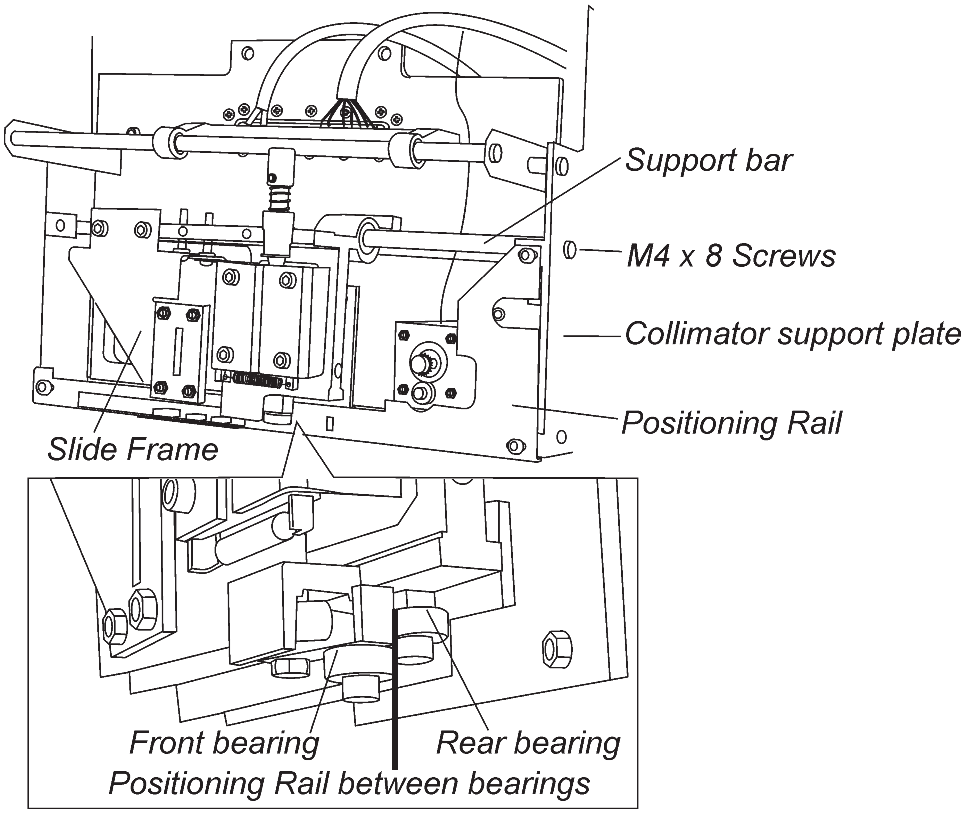
8. Attach the Ceph Aperture CCD to the inside of the Side Frame, if it is not already attached (M4 x 8). Note that the side of the Ceph Aperture CCD with the large aperture must face outwards.



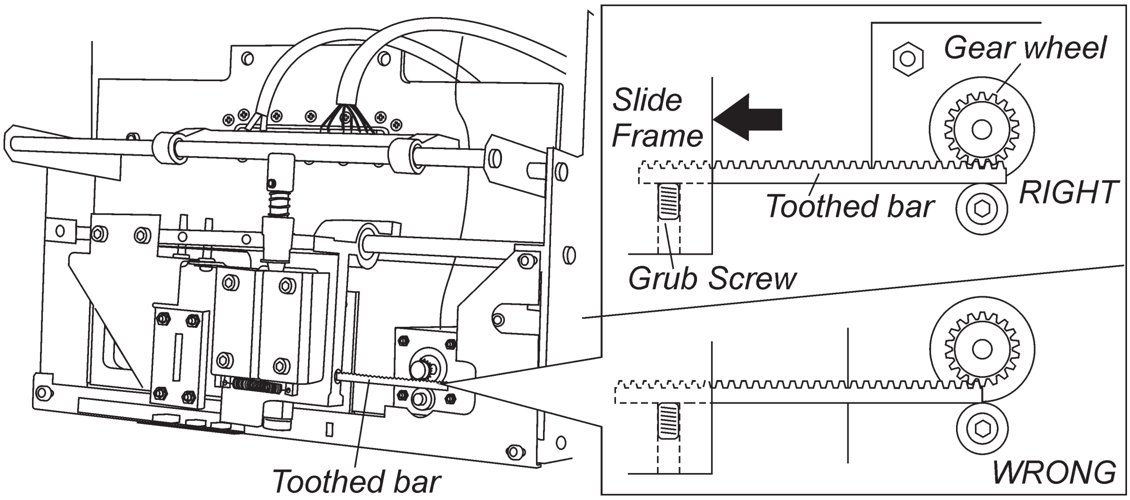
9. Slide the Support Bar into the bearings in the Slide Frame.



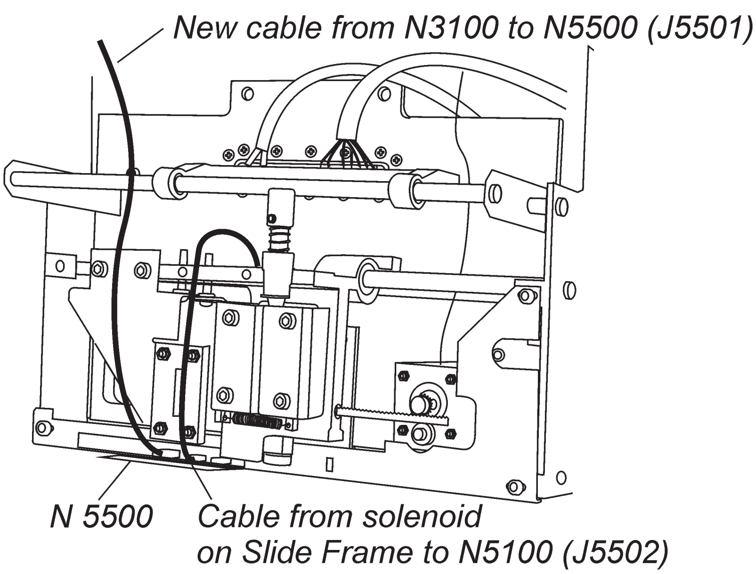
10. Place the Slide Frame on to the Positioning Rail so that the two bearings on the underside of the Slide Frame are positioned on either side of the Positioning rail.
    Secure the Slide Frame in position by securing the support bar to the Collimator Support Plate with two M4 x 8 screws, one at each end of the support bar.



11. Insert the Toothed bar into the small hole in the side of the Slide Frame.
    Position the Toothed Bar so that it engages fully with the motor gear wheel when the Slide Frame is slid to the left as far as it will go. Also make sure that there is no play between the Tooth Bar and the gear wheel. If necessary eliminate play by adjusting the position of the motor.
    When the Toothed Bar is in the correct position secure in position with the M4 x 6 grub screw.



12. Connect the cable that comes from the solenoid on the Slide Frame to N5500 (J5502). Also connect the new cable from N3100 to N5500 (J5501). Use cable ties to secure the cables so that they cannot interfer with the collimator movement.



A2.2 Installing the cephalometric unit

1. Follow the instructions given in section **3.5 Option - Installing a cephalonmetric unit**, in the Installation Manual.

A2.3 Electrical modifications

1. On N55300 connect the jumper to JP1 either to the position R (right hand side ceph) or the L position, depending on the ceph being installed.

2. On N5200 (Digital IO board) connect jumper X15 either to the position R (right hand side ceph) or the L position, depending on the ceph being installed.

3. Remove the jumper from JP1 in N3500 (Motor controller).

A2.4 Software modifications

1. The DfW 2.5 folder name should be altered according to the DfW software supplied.

   The Ceph option must be added to DfW.
   To do this, open the file Dicc.ini (/Soredex/DfW 2.5/) using Notepad, and from the line beginning with "**Devices**" add the text "**,PP1CEPH**" (< s/n **B81642**), "CranexCeph" (> s/n **B91643**) and save the file.

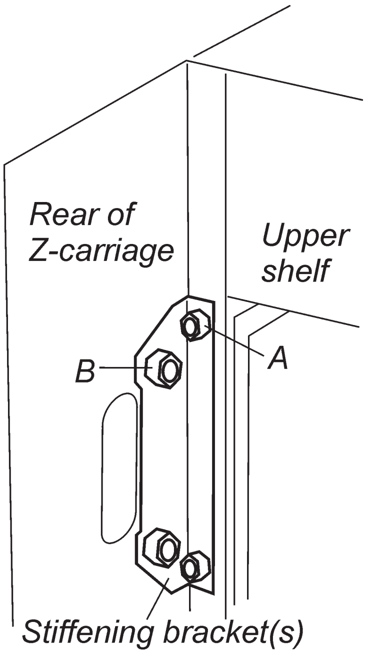
A2.5 Checking the alignment of the unit

NOTE:
A pan/ceph sensor (Type 2) must be used to produce ceph images. The Type 2 sensor is not part of the upgrade kit and must be ordered separately. The Gain Files for the new CCD sensor (on the Cranex D Installation CD) must be installed in the PC.
To do this copy the contents of the CD's folder "Gainfiles" to folder /Soredex/DfW 2.5/Dicc/Ortho/Gainfiles.

1. Reconnect the power supply to the unit and switch the unit on.

2. Align the unit, **pan and ceph**, according to the instructions given in the installation manual.
   IMPORTANT NOTE!
   Perform **all** the alignment steps.

   NOTE:
   When you level the ceph arm, you may have to adjust the position of the stiffening brackets (one on each side of the Z-carriage) to which the ceph arm is attached.
   This can be done by loosening the nuts (A) that hold the stiffening brackets in position, levelling the arm, and then retightening the these nuts as well as the Ceph arm nuts (B).



3. When the unit has been aligned replace all the covers.

4. Take test exposures using every program to verify that the device works correctly.

Appendix A3 - Software Versions

Version 1.10L and 1.10R
Unit versions with seial numbers **B81642** and **earlier**

Version 2.01
Unit versions with seial numbers **B81643** and **later**